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NOTICE TO AUTHORS

Before submitting manuscripts for publication authors should consult Information for Contributors to the Journal of Speech and Hearing Disorders, *JSHD*, 14, 1949, 93-94. Prospective authors are invited to write the Editor for copies of this Note, and of its supplement, Examples of Manuscript Form.

The American Speech And Hearing Association
THIRTIETH ANNUAL CONVENTION
October 25-27, Hotel Jefferson, St. Louis

UNTIL JUNE 15, members of the Program Committee will continue to receive abstracts of papers for presentation at the annual convention. The acceptance of papers is subject to the limitations stated in the 'Formal Call for Papers' of the March, 1954, issue of the *Journal of Speech and Hearing Disorders.*

In large measure, the convention program has been planned to conform to the results of the recent program questionnaire. The Program Committee has made considerable effort to organize a varied subject matter to suit the numerous professional interests of the Members and Associates of the Organization.

Five separate sessions have been planned in each of the following areas of special interest:

Experimental Phonetics (Black)
Organic Disorders of Speech (Carrell)
Hearing and Psychoacoustics (Hirsh)
Speech Therapy (Miller)
Functional Speech Disorders (Villarreal)

A number of special features have been planned for the convention: There is to be a three-day exhibit of teaching materials for speech therapy. Members who have teaching materials that may be of interest are invited to submit a description to the Chairman of the Program Committee. A Film Theater, showing motion pictures of special interest to persons working in the field of speech and hearing, will be conducted (Kleffner).

Alumni and Organization luncheons are scheduled for Tuesday noon, October 26. Arrangements for luncheons should be made directly through the Chairman of the Committee on Local Arrangements (Goodman).

Meetings of Sigma Alpha Eta have been scheduled.

A special visit to Central Institute for the Deaf has been planned for the morning of Wednesday, October 27. The Association luncheon will be held on Wednesday noon.

Special sessions on Professional Problems (Moore) and on Interrogation (Boland) have again been planned for this convention.

The sessions on Professional Problems have been scheduled throughout the day on Monday, October 25. Suggestions and comments may be directed to the session chairmen as follows:

Speech and Hearing Conservation by Departments of Public Health. Chairman: Ray Cromer, Michigan Department of Health, Lansing, Mich.

Coordination of Speech and Hearing Therapy with Classroom Instruction. Chairman: Dorothy Kester, Akron Public Schools, Akron, Ohio.

Clinicians in College and University Clinics. Chairman: Melvin Hyman, Bowling Green University, Bowling Green, Ohio.

Relations Between Hearing Clinics and Commercial Representatives. Chairman: Donald Markle, Columbia-Presbyterian Medical Center, New York 37, N. Y.

Problems of First and Second Year Therapists. Chairman: Robert McCroskey, Central Michigan College of Education, Mt. Pleasant, Mich.

Private Practice in Speech Correction. Chairman: Paul Knight, 30 N. Michigan Ave., Chicago, Ill.

State Directors of Speech Correction Programs. Chairman: Gretchen Phair, Sup-

ervisor Speech Correction, State of Wisconsin, Madison, Wis.

Hospital Services in Speech and Hearing. Chairman: John L. Boland, University of Oklahoma, School of Medicine, Oklahoma City 4, Okla.

County Programs in Speech Correction. Chairman: Elizabeth MacLearie, Ohio State Department of Education, Columbus, Ohio.

Speech Correctionists in Communities under 200,000. Chairman: Marian Donewald, Evansville Public Schools, Evansville 14, Ind.

Speech Correction in Cities of 200,000 and over. Chairman: Zelda Horner Kosh, Arlington, Va.

State Hearing Conservation Programs. Chairman: Thomas LePine, New York State University.

Sixteen Interrogation Panels have been organized. The sessions are intended to be informal, during which persons in the audience may ask questions of the panel members. In addition to asking questions during the individual programs, members of the Association are invited to write to the chairmen of the various panels before the Convention if they desire to submit questions or opinions to the panel in written form about the respective subject areas. The following Interrogation subjects and panel chairmen have been established:

Private Practice and the Law. Chairman: Harold S. Edmondson, Oklahoma Speech and Hearing Center, Oklahoma City, Okla.

Research in Experimental Phonetics. Chairman: Forrest Hull, Vanderbilt University, School of Medicine, Nashville, Tenn.

Bone Conduction Audiology. Chairman: John W. Keys, University of Oklahoma, School of Medicine, Oklahoma City, Okla.

Counseling Parents in the Clinic. Chairman: John Wortley, Hudson River Speech Center, 35 S. Broadway, Tarrytown, N. Y.

Speech Therapy in the Medical Setting. Chairman: Freeman McConnell, Vanderbilt University, School of Medicine, Nashville, Tenn.

Public Health Speech Therapy and Audiology. Chairman: Courtney D. Osborn, Michigan Department of Health, Lansing 4, Mich.

Therapy for Stuttering Children, 4 to 8 Years Old. Chairman: Frank Robinson, Miami University, Oxford, Ohio.

The Social Worker in the Speech Clinic. Chairman: Mary K. Sands, Arkansas State Teachers College, Conway, Ark.

The Initial Examination of the Speech-Disordered Patient in the Clinic. Chairman: Stanley Berlinsky, University of Michigan, Ann Arbor, Mich.

Speech Therapy, Speech Improvement, Phonics in the Public Schools. Chairman: Sara M. Ivey, University of Arkansas, Fayetteville, Ark.

Professional Relations Between Speech Therapy and Education. Chairman: Charles Parker, University of Iowa, Iowa City, Iowa.

Speech Therapy in the Veterans Administration and the Armed Services. Chairman: Bruce Siegenthaler, Pennsylvania State Univ., State College, Pa.

Professional Training for Private Practice. Chairman: James Frick, Pennsylvania State Univ., State College, Pa.

University Training of Teachers of Lip Reading and Auditory Training. Chairman: Albert Johnson, Pennsylvania Department of Public Instruction, Wyomissing, Pa.

The Status of Speech Therapy in the Public Schools. Chairman: Jack Pearson, State Department of Education, Oklahoma City, Okla.

Professional Relations Between Speech Therapy and Psychology. Chairman: Joseph Sheehan, University of California, Los Angeles 24, Calif.

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Systematic Research In Experimental Phonetics:* 1. A Theory Of The Speech Mechanism As A Servosystem

Grant Fairbanks

EXPERIMENTAL phonetics is the study of the biological action known as *speaking* which produces the acoustical time-series known as *speech.* Numerous biological systems are involved in this action, but it is possible to consider them collectively as a single, larger, bio-acoustical system which is a proper object of study as such. It is this system, the *speaking system,* as a system, that I propose to discuss. While it is impractical to cite all my sources here, I want to mention my reliance upon the writings of MacColl (*3*), Wiener (*9*, *10*) and Trimmer (*8*) in the fields of control theory and cybernetics, and to make special acknowledgement of the personal influences of Seashore, Tiffin and Travis, who originally aroused my interest in the speaking system almost 20 years ago.

*Under this title a section meeting of invited papers was arranged for the 1953 Annual Convention of ASHA by M. D. Steer. The four papers are here published as a group. At the suggestion of Chairman Steer, and with the agreement of the Editorial Staff, they are reproduced, with minor changes, substantially as read in order to preserve the flavor of the original occasion.

Grant Fairbanks (Ph.D., Iowa, 1936) is Professor of Speech and Director of the Speech Research Laboratory, University of Illinois.

By way of review I will first show without discussion five diagrams of communication systems. Figure 1 is from Scripture (*5*), Figure 2 from Shannon (*6*), Figure 3 from Davis (*2*), and Figure 4 from Peterson (*4*). Figure 5 shows Bott's (*1*) unpublished *speaker-listener causal series,* which has been passed on by word of mouth. As nearly as I can determine, it must have been formulated about 1930, antedating the four others. The diagram, which shows only structural elements, does not attempt to do justice to the complete statement.

Figure 6 shows an extension of the Bott scheme to a two-way speaker-listener system. Note that the brain of Speaker 1, B_1 at the left, is the source of Message 1, M_1, and also the destination of M_2, with B_2 serving analogous functions. Note also that each speaker is equipped with a transmitter and a receiver. Reflect that a given receiver, such as E_1, is operative at all times, even when its related transmitter, S_1, is producing signal intended for the independent receiver, E_2. M_1, in the form that it issues from S_1 under orders from B_1, is simultaneously relayed back to B_1 through E_1. In short, Speaker 1 hears himself as he talks. In Figure 7 we divide the diagram down the middle, make certain adaptations, and arrive at a more

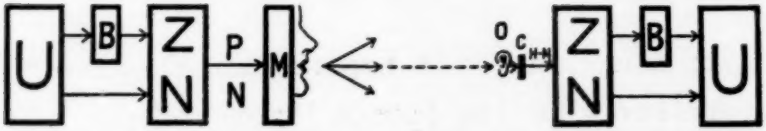

FIGURE 1. Diagram of the speech system. U, das Unbewusste; B, Bewusstsein; ZN, Zentralnervensystem; PN, peripheres Nervensystem; O, Ohr; C, Endorgan im Ohr; HN, Hörnerv. From Scripture (*5*).

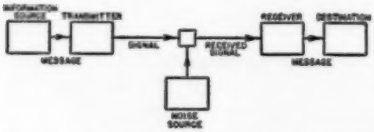

FIGURE 2. Schematic diagram of a general communication system. From Shannon (*6*).

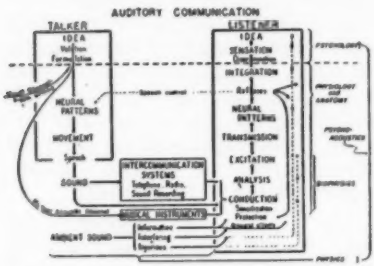

FIGURE 3. Diagram of the process of auditory communication. From Davis (*2*).

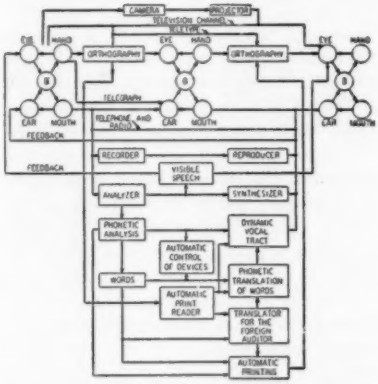

FIGURE 4. Fundamental systems in communication technology. From Peterson (*4*).

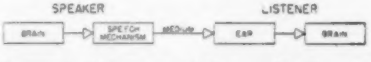

FIGURE 5. Structures of the speaker-listener causal series. After Bott (*1*).

complete diagram of the situation at the time S_1 is transmitting.

The return of M_1 to B_1 has often been referred to in such words as *auditory monitoring*, and interpreted as a sort of 'checking up' on what the speaking apparatus *has* produced. There is nothing wrong with this view of matters as far as it goes, but it seems to me that it misemphasizes the significance of self-hearing during speaking. It stresses the past. The essence of a speaking system, however, is control of the output, or prediction of the output's future. In this kind of system the significance of data about the past is that they are used for prediction of the future.

The 'monitoring' interpretation also suggests that the ear is a receiver in a listening system rather than a component of a speaking system. Theorists emphasize two different kinds of purposes for which measurements are made by the same instruments. Trimmer (7) illustrates this by comparing the use of the same scales, first to determine the unknown weight of a watermelon and then to weigh out exactly five pounds of sugar. In the

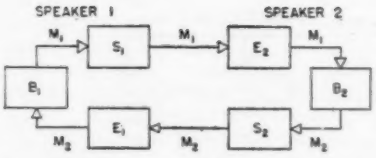

FIGURE 6. Two-way speaker-listener system. B, brain; S, speaking mechanism; M, message; E, ear.

case of the watermelon, the purpose was *estimation* of weight; in the case of the sugar it was *control* of weight. In Figure 7, E_1 and B_1 are measuring M_1 for purposes of control. In Figure 6 they are measuring M_2 for purposes of estimation. When I say a word and you repeat it, your hearing apparatus measures my word for purposes of estimation and then your word (the same word) for purposes of control. When we are referring to the control functions of the auditory signal, I suggest *auditory feedback* as the term of choice.

The speaking system does not seem to be what is called an *open cycle* control system. In open cycle control the device that produces the output is controlled by some quantity that is independent of the output. Devices such as alarm clocks, in which an event is controlled by time, are familiar examples. The speech synthesizers that I have seen employ this form of control. A deaf child, while being taught to speak by a deaf therapist who pursues the method of phonetic placement with a tongue blade, is almost entirely under open cycle control.

A *closed cycle* system, or *servosystem*, on the other hand, employs feedback of the output to the place of control, comparison of the output to the input, and such manipulation of the output-producing device as will cause the output to have the same functional form as the input. The system performs its task when, by these means, it produces an output that is equal to the input times a constant. Examples of such systems are the heating plants of our homes and the homeostatic mechanisms of our bodies. It seems evident that the speaking system has at least the rudiments of a servosystem. In Figure 8 we explore this further with the model shown in block diagram.

If we start with the *effector unit*, shown at the top, we observe a *motor*, a *generator* and a *modulator* connected as shown. These are the respiratory, vibratory and resonation-articulatory structures, respectively. (The model deliberately simplifies. If it were more elaborate, the generator, for instance, would be shown as a multi-unit device capable of producing various types of inputs for the modulator, and in part located physically within the latter.) The *output* is shown by the heavy arrow at the right. The heavy lines and arrows at the top symbolize the effector's motor innervation.

The *sensor unit* at the bottom is so-labelled to emphasize its control function. (If its function were estimation, it would be called a *receiver*.) *Sensor 1* is the primary component for output take-off, the ear. The output is conducted to sensor 1 over two

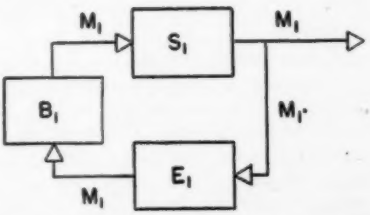

FIGURE 7. Elements of the control system for speaking. B, brain; S, speaking mechanism; M, message; E, ear.

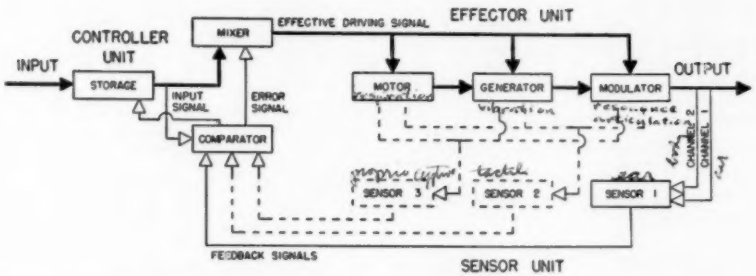

FIGURE 8. Model of a closed cycle control system for speaking.

separate channels, representing the acoustic pathways to the ear through the air and through the body tissues. *Sensor 2* and *sensor 3* symbolize the tactile and proprioceptive end-organs. These supply data about the mechanical operation of the effector, but not directly about its output. Although correlated with the output data taken off through sensor 1, these data are comparatively fragmentary. The sensor unit relays its data to the *controller unit* in the form of *feedback signals*.

The controller is an automatic device that issues specific orders to the effector. It does not originate the message, but receives its instructions from a separate unit not shown. We are concerned here with a speaking system and assume an input, although plausible extensions along these same lines may be made to a model of a language system which also originates messages.

The anatomical analogy is less definite here than for the effector and sensor, and my tendency is to keep it so for the time being. This indefiniteness does not, however, restrain us from fruitful discussion of an automatic controller in terms of functional units, and, of course, we should remind ourselves all along that this is a model, not a replica.

While a closed cycle heating system, for example, may be required only to maintain a constant pre-set temperature, the speaking system must vary its output as a function of time, according to instructions laid down at the input. The output consists of qualitatively different units that must be displayed in a time sequence that is unique. The selection and ordering of units are carried on in advance, usually for a number of units, and represent a set of input instructions. As speaking continues, each set is replaced by another. As the first component of the controller, therefore, we provide a *storage* device, which receives and stores the input and gives off an *input signal*. The number of units that it can store is comparatively small and the time that it will retain them is short. This is the short persistence memory of what we intend to say next. We may think of this device as a tape recorder in which instructions are stored. Its tape drive is alternately started and stopped, and when the tape is stationary a given unit of instruction is repeatedly reproduced by a moving scanning head.

A stored unit of instruction, or input, corresponds to a unit of output. Each such unit furnishes what is termed a *control point*, sometimes

called *set point*. The control points are the unit goals of the output. The input signal corresponding to a control point goes simultaneously from the storage component to the controller's other two components, a *comparator* and a *mixer*. The comparator also receives the feedback signals, as stated earlier. With the input and feedback signals it performs a calculation, essentially subtraction, in which it determines the difference between the two. At any given time it thus yields a measure of the amount by which the control point has not yet been reached by the output, or a measure of the non-accomplishment of the control point. This measure is termed the *error signal*. In the act of speaking, the error signal, at the time in question, is the amount by which the intended speech unit, then displayed in the storage device, has not yet been produced by the effector.

The error signal will equal zero when the control point has been achieved by the effector. At such a time as it does not equal zero, the error signal provides data which cause the effector to modify its operation in such a manner as to bring the error signal closer to zero. It continues with time to modify the operation of the effector progressively so that the error signal approaches and finally reaches zero.

To bring this about the error signal is continuously fed into the mixer, the function of which is to combine error signal and input signal into the *effective driving signal*. The latter furnishes specific instructions to the effector. It alters the effector's operation, causing its output, relayed back to the comparator in the form of feedback signal, more nearly to equal the input signal and thus reduce the error signal. The reduced error signal is then fed into the mixer, modifies the effective driving signal accordingly, and so on around the loop until the error signal equals zero.

At such a time the first unit has been completed and the system is ready for new instruction. The information that that is the state of the system is given, we repeat, by the fact of zero error signal. In the model you will note that the error signal is fed into the storage component as well as into the mixer. In the storage component, however, it acts in simple all-or-none fashion to trigger display of the next control point when it equals zero, or to retain a given control point when it does not equal zero. In the tape recorder that we imagined earlier as the storage device, it would start and stop the tape drive.

This triggering device has an important refinement of that basic operation. Since the time constants of the live speaking system are relatively long in comparison to the durations of steady states in the output, analogous time constants are assumed for the model. This being the case, the system would have a low ceiling on its rate of output, if advancement of instructions were permitted only at times of zero error signal. The comparator includes, therefore, a predicting device. By plotting the error signal as a function of time during production of a given unit, this device continuously predicts by extrapolation the future time at which the error signal will equal zero. Thus advancement of the storage component to the next control point is not necessarily delayed until the actual moment when a condition of zero error signal obtains. It may be triggered in advance of that time by an amount, let us say, equal to the relevant time constants. By this means, over suitable channels, a new input can be started on its way toward the effector before

the previous control point has been reached so that it will arrive there at an appropriate anticipated time.

It may have been observed that, when the model starts operation from the inactive state, the effective driving signal is not at the outset modified by the error signal, there being as yet no error signal. Under such conditions the output is uncontrolled for an amount of time equal to the time constant of the entire system. This is inherent in a feedback-controlled system unless the time constant is negligible. In the live system it is suggested either that the excitation of the effector is highly generalized, resulting in an initial output that is undifferentiated until it comes under control, or that the effector's operation during this initial period is mediated by subtle programing of sequences not dependent upon sensory feedbacks.

The system has another important undiagramed characteristic. In the mixer the rate of change of the effective driving signal is caused to vary with the magnitude of the error signal. When the error signal is large, as at the start of a unit, the corrective change is rapid. It becomes progressively slower as the error signal is reduced. An advantage of this feature is reduction of overshoot.

Numerous times we have used the term *unit* in the sense of unit of control. Such a control unit should not be identified with any of the conventional units such as the phoneme, the syllable, the word, or the word group. There is no time to develop this idea for the live speaking system beyond saying, first, that it is not theoretically necessary that the unit of control be any presently identified phonetic unit, and, second, that we have evidence from several experiments suggesting that it is something else. It might be ventured tentatively that the unit of control is a semi-periodic, relatively long, articulatory cycle, with a correlated cycle of output. It is more satisfactory at present, however, merely to propose the existence of a hypothetical unit of speech control, as yet unspecified and unnamed, whose characteristics are dimly coming to be seen.

The idea of building a mechanical model of the speaking system that we have discussed is appealing. Comparatively simple effector and sensor components which can process recognizable speech signal are within the art. We hope shortly to begin construction of a simple controller, based on a relay network, that works on paper. Although to validate the theory it is not necessary that the machine talk, it seems possible that a first approximation to connected speech can be realized.

One evident feature of the model, as well as of the live system, is that it contains many components in a complicated arrangement and readily becomes disordered. One type of disorder is part failure. In that case, unless the part can be replaced or repaired, the change in output must either be compensated or tolerated. A part disorder is also a system disorder. The model can be caused to repeat, prolong and hesitate by several different manipulations, one of which is feedback delay. By manipulations that are revealingly similar it can be caused to make other kinds of mistakes, such as substitutions, distortions and omissions. All such disorders are demonstrably caused by component deficiencies. In the model *organic* and *functional* are one.

Since the dynamic events of connected speech have become conveniently accessible through the X-ray motion picture and the acoustic

spectrogram, students of speech perception have been giving considerable attention to the psychophysical significance of spectral changes in the speech signal. Although this subject is outside the scope of the present paper, a brief comment seems worthwhile.

Phoneticians have long recognized that the elements of speech are not produced in step-wise fashion like the notes of a piano, but by continuous modulation as a function of time. Certain of the elements, such as the diphthongs, involve characteristic changes during their durations, losing their entities if they do not so change. Other elements, such as the vowels, may be prolonged indefinitely in the steady state and change is not considered to be a defining feature. During production of elements of the latter type in connected speech, however, changes occur. Movements to and from articulatory positions result in acoustic transitions to and from steady states in the output.

In the model we have seen how a transition is used for purposes of control and prediction. From it is derived a changing error signal. The model's objective is to reduce this error signal to zero, and at such a time as that has been accomplished the control point will have been reached. In the case of the production of elements of speech that involve steady states, the control points and error signals correspond, respectively, to steady states and acoustic transitions in the output. It is to be emphasized that the steady states are the primary objectives, the targets. The transitions are useful incidents on the way to the targets. The roles of both are probably very analogous when the dynamic speech output is perceived by an independent listener.

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Systematic Research In Experimental Phonetics: 2. Signal Reception: Intelligibility And Side-Tone

John W. Black

THE TREATMENT of speech that the present title suggests encompasses less than the whole of the speech process; yet, extends beyond the vocal folds and articulators. The peripheries might be set through expanding the idea of successive orders of approximation of statistical samples of language (*35*). From a sample of a speech of considerable length, single-word events at one-second intervals might be abutted, yielding an acoustic sample of language with no context and, from the limited view of vocabulary, *first order approximation* to language. (At this stage we have bypassed *zero order approximation*—a mere enumeration of the event—and have weighted the event by the frequency of its occurrence.) The discontinuities of language and the acoustical and physiological aspects of speech would be reduced with succeeding steps toward an idealized statistical sample or higher *orders of approximation*. The fitting together of events to yield pairs of events that occur successively in a criterion usage would provide the *second order approximation*; this pair together with a succeeding or third event that turns up as a three-event sequence in the criterion usage would give the *third order approximation*; etc. Constraint upon constraint, the outcome would be a sample of speech, an individual's or a culture's, with the minute units drawn from experience and projected as probability. Each word would occur in the sample because it fitted first, the word code and second, the simultaneous occurrences: a stage of the respiratory cycle, frequency and phase of vocal-fold movement, a level of sound pressure, etc. The sample would exemplify a speech pattern, context *out* and speech production and transmission *in*, and might be studied as a project in *speech science, voice science, psycho-acoustics, bio-acoustics, language science, experimental phonetics,* etc., and conceivably under a title, 'Signal Reception: Intelligibility and Side-Tone.' The assumptions are: (a) the original signals from which the sample was drawn were uttered purposefully, and (b) were monitored by the speaker. The former implies a context of listeners and the latter, side-tone.

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Intelligibility

In purposeful speech the signal fits a code that the listener is presumed to know. Somewhat in the manner that a card sorting machine feeds cards to designated bins, the listener sorts and identifies acoustic signals. This identi-

fication is *intelligibility*, a concept that can be applied to any unit of the voice code: sounds, syllables, words, sentences, level, rate, inflection, etc.[1] Relative intelligibility scores were determined for some of these in the 1920's and reported by Fletcher and Steinberg (*19*). For example, the relationship between letter and syllable articulation was determined. Later, Egan compared articulation scores for sentences and for words (*14*). Sentence intelligibility exceeds word intelligibility in that sentences facilitate reception through supplying a running sequence of symbols that 'follow the rules' and through exemplifying the familiar probabilities of sequential language. The successive words may, however, have an established aspect of probability without sustaining an idea, as in the *statistical sample of language*. The contribution of successive orders of approximation to intelligibility has not been reported. Through projecting Miller and Selfridge's findings (*31*) on *retension*, however, some effect would be expected in the circumstance of *reception*.

Intelligibility as a rationale for scientific inquiry into speech and *intelligibility* testing as a device for obtaining measures are, of course, not synonymous. Our knowledge of the former derives from available tests, however, although the validity of the tests has not been completely demonstrated (*8*, *14*, *19*, *23*). The test assigns higher scores to individuals who have pursued a course of training that has been called 'intelligibility' than to comparable individuals who have not undergone this training; etc. (7, *23*). A multiple-choice intelligibility test yields results that are internally consistent with split-half correlations of .85 - .92 and item consistency of .89 (*8*, *23*). With respect to the communication channel to which the speaker is coupled, the intelligibility test can appraise (a) the signal source—that is, the speaker —or (b) the transmission line, e.g., an air-filled auditorium or an electronic device for transferring or storing speech, or (c) the code channel of speech. Early applications of the tests were to transmission lines, particularly the telephone, and rooms. We are familiar with Fletcher's tests of the phonetic code in which he modified the line with filters, low and high pass, and determined intelligibility as a function of the phonetic spectra. From other threshold tests he was able to infer the relative sound pressure level of the various phonemes (*17*).

The criterion score of intelligibility has been applied to sound pressure level and has yielded similar functions for both write-down and multiple-choice tests (*14*, *8*).

Limited efforts to verify subjective evaluations of precision of articulation through the use of intelligibility tests are less convincing than one might suppose. Penningroth, however, in a comparison of teacher-selected students with 'good' and 'poor' articulation, found significant differences in intelligibility scores (*33*).

Systematic psychophysical studies may yield some unexpected accom-

[1]Auditory acuity has been sporadically evaluated at least since 1874 by word-reception scores (*40*). Currently standardized word lists and recordings of these lists and calibrated equipment for playback give word-reception tests an established place in audiometry and provide criterion scores in studies of the hearing function (*25*). In the interest of unity, no treatment of intelligibility with reference to auditory acuity is included here. The listener's reception and integration of aural signals is assumed to be 'normal' and an adequate number of listeners to represent a generalized listening ear is taken for granted.

paniments of the 'higher' intelligibility scores. Evidence concerning the effect of rate of utterance and the duration of a single phoneme upon intelligibility is not conclusive although a longer syllable attends speech of greater sound pressure level (*13*). Within broad limits, rate may be of small consequence, with the qualification that a speaker's normal rate may be his optimum one (*24*). In one preliminary comparison two copies of a recorded intelligibility test were prepared. One was edited to make the items irregularly spaced in time. The scores yielded by the irregularly spaced items were not different from the comparable scores for regularly spaced ones. Should further results indicate that temporal aspects of utterance are inconsequential from the standpoint of listener reception, an experimental attack upon maximum utilization of the communication channel would be indicated. Miller and Licklider (*30*) and Garvey and Henneman (*21, 22*) demonstrated that a considerable portion of the speech signal could be destroyed—removed from the temporal sequence—without materially affecting intelligibility (*26*). The Fairbanks-Everitt-Jaeger time compressor (*15*) should provide unusually good opportunities to study this function.

The multiple-choice intelligibility test permits the listener to respond rapidly, a feature that has been exploited through editing a recorded version of the test and spacing successive items nearer each other until the items at the end of a test are temporally adjacent. Certain transmission lines, particularly microphones, have been distinguished through yielding differential scores on these 'Response Readiness' tests. The tentative interpretation is that 'broad-band quality pays off' through yielding more rapid interpretation (*11*). Some such technique might establish intelligibility as a function of voice quality.

Presumably any relationship between the fundamental frequency of voice and intelligibility is coincidental. Both intelligibility and an individual's fundamental frequency are related to sound pressure level, for as a person talks louder he both raises his pitch and his intelligilibility. Persons of different natural pitches do not seem to vary systematically in intelligibility, however; nor does the same person improve with deliberate changes in fundamental frequency with level held constant (7, *10*).

Only a start has been made in relating the code of speech to intelligibility, a study that is dependent on more knowledge about the statistics of language. That some words occur disproportionately frequently led to the Thorndike word lists and other more restricted quantifications of the frequency of word usage (*2, 20, 37, 38*). The intelligibility of a word, in turn, is related to the frequency of usage: the 'more often' words are the more intelligible (*4*); and words of a small vocabulary are more intelligible than words of a large vocabulary (*29*). In another terminology the more highly probable a word is as a 'next' acoustic occurrence, the more intelligible it is; and as words have their probabilities so do phonemes and sequences of phonemes (*12, 35*). Some groupings of phonemes are more common, for example, in four-sound one-syllable words than in three-sound one-syllable words, and in this limited set of circumstances, knowing one sound of a four-sound one-syllable word, a listener has more chances of guessing a succeeding sound than with three-sound one-syllable words. As a confounding matter, four-sound one-syllable words are more intelligi-

ble than three-sound one-syllable words. The difference may be attributable to the number of acoustic events, but it must be re-studied from a viewpoint of phonetic probability.

Intelligibility was given a broad definition above—one that encompassed the recognition of all codes and channels in speech. The discussion has emphasized phonetic and word intelligibility. There are other channels and codes of importance. O'Neill has quantified the relative contribution of vision in the reception of speech by normal hearing adults (*32*). Fairbanks and Pronovost demonstrated an association of common meaning with non-phonetic aural aspects of speech as simulated emotional states were identified in voice (*16*). More study to determine the codes of extra messages in speech is in order. The relevant 'intelligibility test' is difficult to envisage. Preliminary studies have not revealed the code for *command*, *decision*, *certainty*, *urgency*, etc. That such work is needed, both as a segment in a systematic approach to speech and to verify or displace some goals in performance courses in speech, is apparent.

Side-Tone

From the listener's view of signal reception, with an emphasis on intelligibility, we turn to the other half of this 'system of speech': the talker and his auditory experience of side-tone. Among the notes and class exercises of the introspectionist phychologists we should find references to 'reactions to one's own voice.' The earliest reference that I know, however, is a sheaf of papers initialed by Harvey Fletcher, dated 1918, and marked *original copy mislaid*. One of four terse conclusions states:

> As an approximate relationship the results indicate that, in a circuit having a greater equivalent than 30 miles, one mile reduction in side-tone from normal side-tone is equivalent to something more than ½ mile increase in receiving efficiency (*18*).

This quantification of 'People talk louder when the side-tone is attenuated' was made by Fletcher, Raff, and Parmley. The topic largely lay dormant until workers of many fields were inspired to study feedback in the wake of *Cybernetics* (*39*). As an exception Békésy in 1941 wrote in German 'On the hearing of one's own voice' (*3*). He estimated that the effective level of the internal bone-tissue conducted sound is about equal at the cochlea to the level of the air-borne signal. Presumably many different delays are inherent in this multi-transmission line from the source of speech to the receptor—a fact that may account for some of the difficulty that attends the study of side-tone.

Side-tone in the speech event might be important because it is inherent. There is more to it than that. There is some humor in a situation in which a speech correctionist and a speech defective make sounds at each other with neither knowing how he sounds to the other. There are four experiences: the correctionist's notion of what he is saying, the defective's notion of what the correctionist is saying, the defective's notion of what the defective is saying, and the correctionist's notion of what the defective is saying. When the story of side-tone is written we may lament that we did not declare a moratorium on much speech correction, voice and diction courses, etc., with *Cybernetics* until we found the nature of feedback in speech and how to cope with it.

We know quite a bit about side-tone already. Lightfoot and Morrill

re-studied the telephone problem of Fletcher and expressed the results in sound pressure level and intelligibility scores (*27*).

We also know that when the side-tone is delayed in time, the coding machine breaks down and is unable to progress with its usual rate (*5*). Two values here are of special interest, .06 sec. or the approximate duration of a phoneme, and .18 sec. or the approximate duration of an English syllable. With the former, the greatest increment of 'effect' may occur; with the second, the maximum effect.

The minimum transmission time from the vocal cords to the cochlea has been estimated by Stromsta as .0003 sec. (*36*). The minimum transit time could be the only one that need concern us; or other pathways and times may be equally important, as those that accompany the transmission of sound from the teeth or circuitous internal pathways including the routes of reflections between the origin of the sound and the receptor. Likewise the external side-tone is not a single event as it arrives at the tympanic membrane from a direct airborne channel and from reflecting surfaces. Nor do these various times of delay 'stand still.' The internal ones are altered by vertical movements of the larynx and mandible, by clenching the teeth, etc. and differ from individual to individual; and the external ones vary with each set of reflecting surfaces. Several observations lead us to suspect that this system of delays serves as a brake on the rate of speaking, as an attenuator to precision of articulation, and leads to an error in the estimation of one's vocal pitch. Positive results with regard to two of these suppositions are being presented at this meeting. (a) As Peters removed the delay of the external side-tone the rate of speaking was facilitated (*34*). (b) Malloy found that an individual sustaining a vowel at a moderately loud level over-estimated his vocal pitch (*28*). Tests relevant to the effect of accelerated external side-tone on the precision of articulation are in process.

Atkinson (*1*) has divided the speech spectrum at about 1600 cycles and fed the lower portion, the higher portion, and the total side-tone to experimental subjects. The results indicate statistically significant differences in the rate of speaking.

At least two major objectives await experimental approaches in the study of side-tone. One is a quantification of the vocal state that the individual accepts as 'normal.' Apparently there is a magnitude of experience that is satisfactory to a speaker and when external factors alter this magnitude the speaker attempts to restore the original level. Thus he talks louder in some rooms than in others and the presence or absence of an open pathway to a reflecting surface three feet removed or the shape of a reflector 12 inches from the ear affects an intelligibility score significantly (*6, 11*). There is also a rate of progress that is satisfactory to a speaker. Rate and level interact and also vary with the type of verbal task at hand. Thus, the satisfactory rates and levels of reading and impromptu speaking are different (*9*). The satisfactory rate and level may vary with the magnitude of the speaking situation, possibly the degree of responsibility that the speaker feels, etc.

Another major objective in side-tone studies is to reproduce the side-tone experience for study. Some individuals report that this is approximated when they hear recordings of ear-emitted speech.

The study of side-tone parallels

scientific inquiry into intelligibility. Presumably the functions that are to be derived relative to side-tone will be similar to those that are and remain to be quantified with respect to intelligibility. Some of the criterion measures would be the same, although difficult to acquire and in a few instances, to imagine. For example, can you envisage a portrayal of cochlear microphonics attending the sustained [ɑ] (side-tone) and adjacent to it cochlear microphonics attending the sustained [ɑ] (intelligibility)—the same cochlea responding in both instances.

In summary, this presentation has attempted to sketch one view of a systematic study of the non-contextual aspects of the speech process. We may take some satisfaction in the state of our current knowledge with respect to intelligibility and side-tone and further satisfaction that knowledge about signal reception is accumulating rapidly. Our information, however, does not yet meet the needs of teachers, speech correctionists, engineers, and other 'applied' groups who would limit their activities to established facts.

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Systematic Research In Experimental Phonetics: 3. The Case for Dynamic Analysis In Acoustic Phonetics

James F. Curtis

STUDENTS have long been interested in the exact description of the acoustic characteristics of speech sounds which enable these signals to be recognized by listeners as phonetic entities. The problem is more inclusive than just the description of the acoustic characteristics of sounds which are generated by the human speech mechanism; it is equally important to sift out those characteristics which are actually utilized as significant cues to speech perception as distinct from those characteristics which are merely incidental, or non-significant by-products of the speech generating process.

At least until very recently, most of the research which sought to describe the basic acoustical characteristics of speech sounds was based on certain assumptions about the units of analysis. These assumptions have had operational importance in determining both the kinds of measurements which experimenters have employed and the kinds of measurements they have considered unimportant. These assumptions have also had importance in influencing the interpretation of data. Among these commonly held assumptions have been the following:

1. It has been assumed that the continuous flow of speech can be broken down or quantized, as we customarily do when we transcribe speech into phonetic symbols, and that these units have integral characteristics which are independent of the contexts in which they occur. It is not intended to imply that researchers have been unaware of the interactions which exist among speech sounds which are spoken in sequence. But for purposes of describing the essential acoustical properties of speech sounds, these interactions have been largely ignored. Researchers have sought to describe what have sometimes been called the 'invariant characteristics' of speech sounds which it is assumed would exist under all conditions of speaking, i.e., independent of preceding or following sounds, rate of speaking, and other contextual factors.

The other assumptions are really subordinate or corollary to the broad one just stated, but they are, perhaps, important enough to be emphasized by separate statement.

2. Since these phonetic units are assumed to be separable, independent entities, it has been further assumed that suitable acoustical analysis would yield a single set of values for each which would be adequate to specify

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its significant acoustical characteristics. It has been universally recognized, of course, that such sounds as the stop consonants have an essential time-pattern character. For the most part, however, and especially for vowels, the single set of values assumed to be the goal of analysis have been sought within a single cross-sectional view taken at that point in time where the speech sound was considered to be least contaminated by the surrounding sounds.

3. Implied in both 1 and 2 is the assumption that the time variations which are known to occur when sounds are spoken in context are unimportant by-products of the process of linking sounds together. The general tendency has been to consider them as incidental rather than essential characteristics and as obscuring the real nature of the sounds rather than contributing to the cues which enable the spoken sounds sequences to act as discriminable speech signals.

In recent years a number of researchers have taken a rather different tack. Instead of assuming that the essential characteristics of speech can be described by an essentially cross-sectional type of analysis, they have employed more dynamic analytical procedures in which the variations occurring in time which result from the inter-linking of sounds in sequence have begun to be investigated for their own sake, to see if these features of the continuous flow of speech may not yield cues which aid in the listener recognition of sounds. The results of these studies are sufficiently challenging to compel attention. They seem to cast serious doubt upon the soundness of those assumptions which have been previously enumerated and to call for a recasting of our thinking into a framework which assigns greater possible significance to the kinematic features of speech sounds.

By far the greater portion of research in acoustic phonetics has been concerned with the analysis of vowel sounds.

In 1916 D. C. Miller wrote (*4*), 'The tone quality of vowels has been more closely studied than that of all other sounds combined, and yet no single opinion of the cause of vowel quality has prevailed.' Now, after nearly 40 years of additional study of vowels the first part of Miller's statement is probably even more true than it was in 1916, and we are still far from a clear and definitive understanding of the acoustical characteristics which distinguish among all of the various vowels.

As illustration of the lack of unambiguous specification of the acoustical characteristics of vowels some data have been taken from a recent publication by Peterson and Barney (*6*). Figure 1 presents some results of their measurements of frequencies for the first two formants of vowels produced by 76 speakers—33 men, 28 women and 15 children.

The vowels analyzed in this study were spoken in words such as heed, hid, hayed, head, etc., each of which began with the consonant [h] and ended with [d]. Formant frequencies were measured from amplitude cross-sections obtained with a sound spectrograph. The point in time for each cross-section was chosen to represent the central, 'steady-state' portion of the vowel as spoken in these words.

In Figure 1 the frequency of the second formant has been plotted on the vertical scale and the frequency of the first formant has been plotted by reference to the horizontal scale.

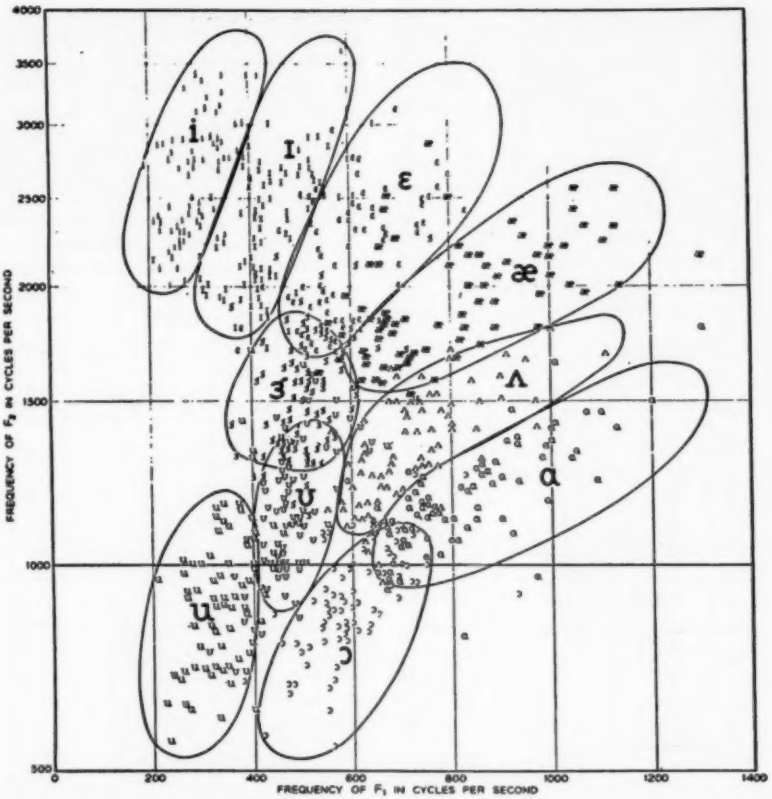

FIGURE 1. Frequency of second formant *versus* frequency of first formant for 10 vowels by 76 speakers. (From Peterson and Barney, 6.)

Each vowel has thus been assigned a point on the plane of this graph according to the frequencies of its first two formants. Hence, if these coordinates are sufficient to describe the essential acoustic characteristics of these vowels, which enable them to be perceptually discriminated, they should be located in such a way that the groups of points corresponding to any vowel would be clearly separated from the groups corresponding to different vowels. As is readily apparent from the graph, no such clear separation is found.

A possible explanation for the considerable scatter of points for particular vowels and overlapping of groups of points for different vowels is, of course, that some of the various vowels may be poor examples of the phonemes that they were intended to represent, i.e., they are perceptually ambiguous. This possibility was considered by Peterson and Barney. They presented all of the recorded

words from which these measurements were made to listeners and obtained judgments concerning the vowels which the listeners actually thought they heard. Figure 2 shows the graph for only those vowels on which 70 adult listeners unanimously agreed on the vowel actually spoken. It is apparent that, although the scatter and overlapping may have been slightly reduced, elimination of those examples which may have been perceptually ambiguous does not mend matters very materially so far as improving the precision of the acoustic specification is concerned. The conclusions of the authors on this matter were as follows:

> . . . the distributions of measured formant values in these plots do not correspond closely to the distributions of phonetic values. . . . It is the present belief that the complex acoustical patterns represented by the words are not adequately represented by a single section, but require a more complex portrayal.

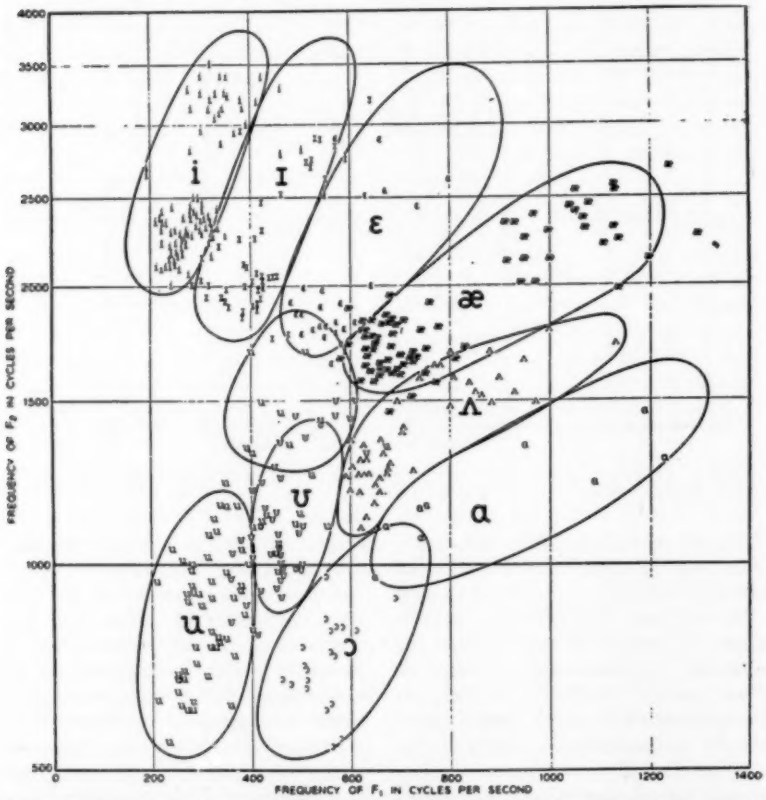

FIGURE 2. Frequency of second formant *versus* frequency of first formant for vowels spoken by men and children, which were classified unanimously by all listeners. (From Peterson and Barney, 6.)

In a later publication Peterson (*5*) has shown that for sustained vowels which are produced under conditions in which extreme care is taken to insure very close equating of phonetic values, specification of the frequencies of the first three formants serves quite well to distinguish among the front vowels. Such vowel phonations are scarcely typical of continuous, connected speech, however. Hence, the problem of what acoustic characteristics must be specified as the necessary and sufficient cues utilized by the listener in the more ordinary speaking situation is still not completely answered.

It will be recognized that the various points which have been illustrated by the data from the Peterson and Barney study apply at least equally to most studies of vowels. In general, the approach ordinarily employed has been essentially cross-sectional. Either a short time-slice has been selected from the central portion of vowels produced in context, or the vowels analyzed have been sustained, detached vowels. In either case, the assumption is clearly implicit that speech can be quantized into independent phonetic units which can be adequately represented by a single set of values. In general, too, the results have been characterized by ambiguity, i.e., scatter of values for what are presumably phonemically, if not phonetically, equivalent vowels, and overlapping of values for what are presumed to be phonemically, and phonetically, distinctive vowels.

Obviously, at least two explanations are possible for the lack of definitive specification of the significant acoustical characteristics of vowel sounds from such cross-sectional studies. One is that all of the important parameters which must be measured are present in the cross-sectional representation, but that investigators have not yet succeeded in hitting upon the particular measurements, or set of relationships, which will provide a clear-cut acoustic description. The other is that the characteristics which we seek are simply not all present in a single cross-section of the vowel's time pattern. In other words, there are kinematic characteristics which serve as cues to the listener in recognizing and distinguishing among different vowels.

As a preliminary investigation of the latter possibility Tiffany (*8*), in 1951, completed a study at the State University of Iowa in which he attempted to manipulate experimentally some of the characteristics of vowels which vary with time. The ones which he chose for experimentation were: vowel duration; pitch inflection; and phonetic context. Four speakers produced the required vowel phonations which were recorded on magnetic tape. After certain editing had been performed, these were submitted to a panel of 18 listeners who attempted to identify each of the vowel stimuli. Table 1 summarizes the identification data obtained by Tiffany. The values in this table are the actual number of times that listeners identified each of the vowel stimuli as being the vowel which it had been presumed to be by the speaker and experimenter. A perfect score for each vowel for each condition is 144. The duration in seconds of the vowels is indicated by the numbers in the first row at the top of the table. Each of the vowels for which a duration is thus indicated were originally produced as detached, sustained vowel phonations of longer duration than the numbers indicate. They were re-

TABLE 1. Total number of correct identifications of 12 vowels under each of 12 conditions of duration, pitch inflection and phonetic context.* (From Tiffany, 8.)

	Condition											
	0.08		*0.2*		*0.5*		*8.0*		*Iso.*		*[t]-[p]*	
Vowel	*I*†	*NI*‡	*I*	*NI*	*I*	*NI*	*I*	*NI*	*I*	*NI*	*I*	*NI*
e	19	5	53	32	92	60	89	96	141	135	140	142
ʌ	109	110	107	103	79	94	97	98	125	116	113	108
ɔ	97	72	121	95	131	120	107	126	102	90	88	98
ɪ	139	118	114	106	66	58	89	52	92	121	143	143
ɛ	116	113	137	112	120	107	73	86	141	118	112	128
ɑ	51	45	94	106	136	101	136	111	103	101	136	138
ʊ	131	125	126	118	91	97	90	83	128	113	129	116
o	100	119	131	114	140	127	128	115	142	127	142	136
u	131	127	141	138	139	142	144	141	130	136	134	139
æ	124	118	142	124	144	143	144	144	143	144	144	144
i	135	135	144	143	143	144	143	144	139	143	144	142
ɝ	143	142	144	140	144	144	144	144	144	144	144	144
Mean	108	102	121	111	119	111	115	112	128	124	131	132

*Each entry based upon the correct identifications of 18 listeners hearing the vowels of four speakers presented twice. Maximum cell total, 144.

†Inflected.

‡Not inflected.

duced in duration to the indicated figures by the expedient of cutting out a suitable length of magnetic tape from the midportion of the longer sustained vowel recordings. This procedure not only resulted in vowels of the required duration; it also removed any cues which might be associated with the normal onset and decay characteristics of the sounds. The two double columns farthest to the right present values for vowels which were presented to the listeners exactly as they were spoken. In these vowel stimuli the normal beginning and ending characteristics were therefore preserved. The 'I' and 'NI' captions indicate the pitch variation, 'I' standing for inflected and 'NI' standing for level pitch or not inflected. Space does not permit a detailed discussion of the comparisons shown in this table. The point to be made is that some of the kinematic variations of vowel sounds apparently do make an appreciable difference in the correctness with which listeners are able to recognize certain vowels. The differences with respect to duration are particularly striking. It may also be noted that certain vowels are apparently very distinctive as indicated by the fact that the recognition scores for these vowels were nearly perfect under all of the conditions of the experiment. Interestingly, these are the same vowels which Peterson and Barney found were recognized most consistently. It is of interest, also, that, although the recognition scores did not in general seem to be adversely affected by the lack of phonetic context, there are a couple of notable

exceptions, especially the vowels [e] and [i].

Without attaching undue significance to the data from this single preliminary study, the data may be interpreted as indicating that perception of certain vowels may be affected by such non-static factors as duration and phonetic context and, to some extent, by presence or lack of pitch inflection. If this is true, it follows that the acoustical characteristics of certain vowels which serve as cues to their accurate identification by listeners cannot be completely specified by means of a purely cross-sectional type of analysis.

Even more than with vowels, recent work on consonants has tended to show that the kinematic changes occurring in the continuous flow of speech may be the source of important perceptual cues. The recent work of House and Fairbanks (*3*) has shown that the consonant contexts in which vowels occur result in systematic differences with respect to the duration, phonetic power and fundamental frequency of those vowels.

Although these investigators did not undertake to consider the question of the perceptual cue value of these variations their systematic nature strongly suggests the possibility that they could serve as significant cues.

More directly on the point of the perceptual significance of such interactions among consonants and vowels are the studies of Cooper and DeLattre and their associates as Haskins Laboratories. In a very interesting series of experiments they have shown that it is not only possible, but very highly probable, that important cues to consonant perception inhere in the transitional variations in the vowel spectrum which are associated with a particular

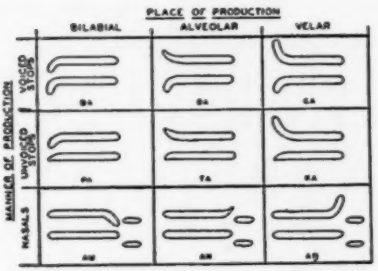

FIGURE 3. An arrangement according to articulatory categories of spectrographic patterns which are heard as syllables consisting of the voiced stops, unvoiced stops, and nasal resonants paired in each case with the vowel [ɑ]. (From Cooper, et al, *1*.)

consonant-vowel linkage. Figure 3, taken from one of their recent publications (*1*), will help to illustrate this point. Equipment developed at the Haskins Laboratories enables them to synthesize simulated speech from spectrographic patterns in which the vowel formants can be manipulated at will. These investigators have shown that the way in which the formant frequencies are varied (as shown by the curvature of the bars in Figure 3) during the transitions into and away from the central portion of a vowel provide important cues to the identification of the preceding and following consonants. This is a result which was suggested by the spectrographic analyses reported by Potter, Kopp and Green (7). Cooper and DeLattre and their associates have shown, however, that consonants can actually be perceived, with a consistency considerably greater than chance, from such cues alone, even when the sound presentation contains no energy corresponding to that which we have been accustomed to thinking of as the consonant energy in our usual quantization of the flow of speech.

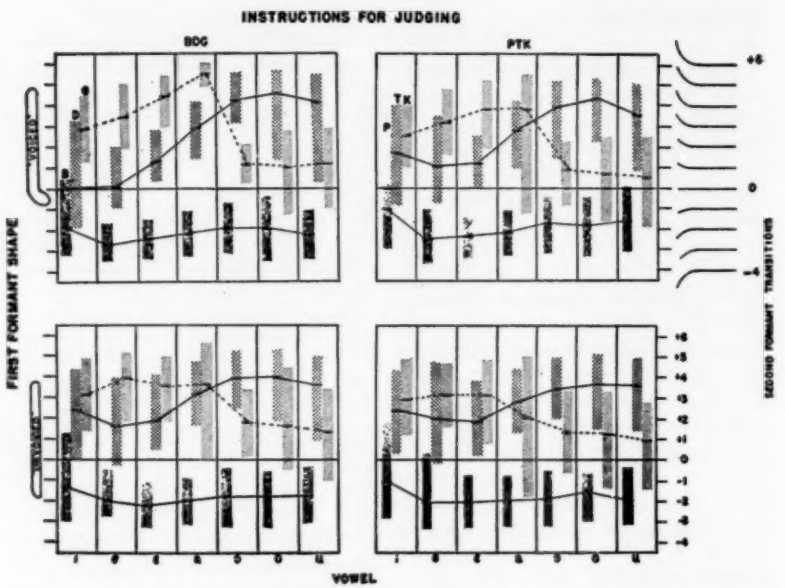

FIGURE 4. Results of four experiments on the contribution of second-formant transitions to the identification of stop consonants. The upper left quadrant is derived from the responses [b], [d], or [g] given by 33 subjects to a set of syllables characterized by a constant rising transition of the first formant, 11 degrees of transition of the second formant (y axis), and seven vowels (x axis). The connecting lines go through the transitions eliciting median responses for each vowel; the lengths of the bars show quartile ranges. The upper right quadrant indicates the responses of a numerically equal, but different group of subjects to the same stimuli, but with instructions to limit their responses to [p], [t], or [k]. The lower two quadrants are based on experiments which differ from the above only in the employment of stimulus patterns showing no transitions in the first formants. (From Cooper, et al, *1.*)

Figure 4 is a reproduction of one of their graphs. It shows the distribution of consonants judged to be present by listeners who heard only the vowel formant variations indicated on the right side of the figure. It is important to note that these various formant patterns not only influence the consonant judgments, but that the distributions of consonant judgments are different for different vowels. The perceptual significance of such transitional patterns, whose form may vary with the particular sequence of consonant and vowel, seems clearly indicated.

Cooper and his associates have further shown that, for certain consonants at least, there does not seem to be a consistent acoustic energy distribution which the listener identifies as a particular consonant, independent of the vowel with which it is produced. In one experiment they presented sequences of schematized synthetic consonants and vowels. As shown in Figure 5, the schematized consonants consisted of bursts of

sound having constant bandwidth, but varying in frequency location. The listeners were assigned the task of deciding which of the three voiceless stop-plosives [p t k] these bursts most nearly resembled. Figure 6 shows the results of this experiment. The most significant point is that the frequency locations for the bursts which were chosen for a particular consonant varied with the vowel which followed it. In other words the acoustic energy distribution was not an independent unit which produced a consistent consonant response.

Another interesting set of experiments which also point to the importance of the interlinkages between sounds has been reported by Harris (*2*). The work reported in this article was a search for what Harris calls the 'building blocks' of speech. He has performed some interesting experiments by recording words on magnetic tape and then editing the tapes in such a way as to cut out or detach a consonant from the vowel with which it was spoken and attach it to a different word or syllable. It thus becomes linked to a different vowel than the one to which it was linked in its original production. His experiments seem to show that one cannot do this interchanging of sounds among syllables indiscriminately and still preserve the intelligi-

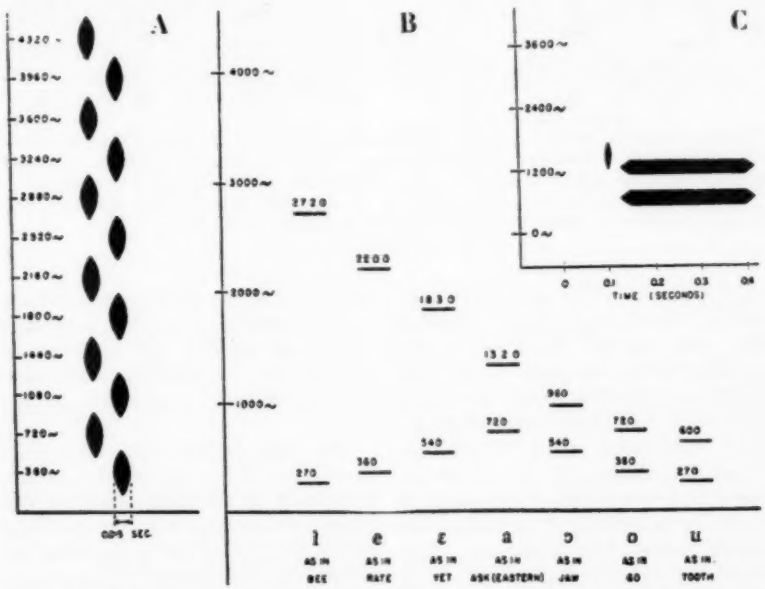

FIGURE 5. Stimulus patterns used in determining the effect of burst position on the perception of the unvoiced stop consonants. (A) Frequency positions of the twelve bursts of noise. (B) Frequency positions of the formants of the two-formant vowels with which the bursts were paired. (C) One of the 84 'syllables' formed by pairing a burst of voice and a two-formant vowel. (From Cooper, et al, *1*.)

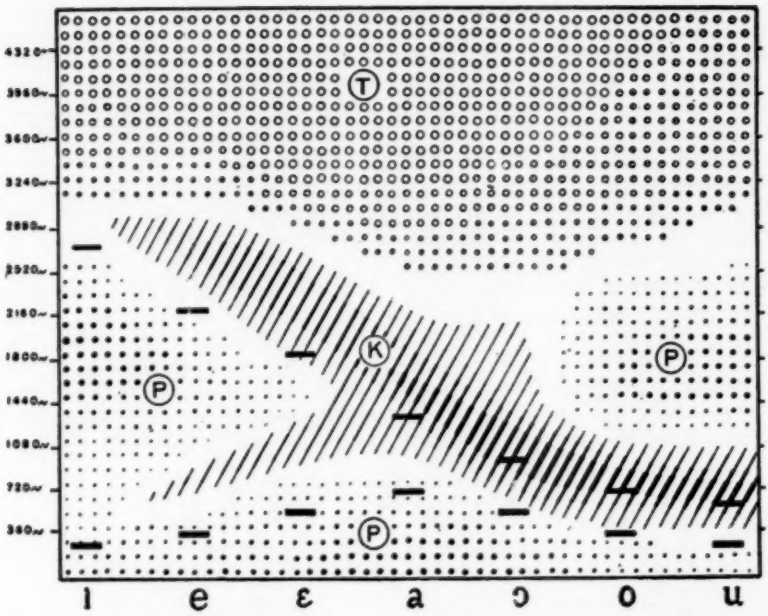

FIGURE 6. Preferred identifications by 30 listeners of the stimuli of Figure 5. The 12 center frequencies of the bursts of noise are shown along the y axis; the seven vowels are arranged in the order front-to-back along the x axis, with formant positions given. The zones show the burst-vowel combinations for which one of the three responses was dominant and indicate roughly the extent of dominance. (From Cooper, et al, *1*.)

bility of speech. To quote from his article, 'These experiments indicated that such speech based upon one building block for each vowel and consonant, not only sounds unnatural but, for the most part, is unintelligible.'

On the other hand, Harris has found that consonants can be interchanged in the manner indicated, if they are interchanged according to certain rules. The significant rules seem to pertain to the nature of the transitional changes which the consonants produce upon the adjacent vowels. Here, then, is still further evidence that the speech sounds which we have tended to quantize as though they were separate and independent entities are, in fact, mutually dependent in some very important respects.

The data which have been presented constitute some of the evidence in support of the thesis stated in the beginning, namely, that there is real reason to question the assumptions on which we have tended to operate in many of our past researches concerning the acoustical nature of speech. The data of these recent studies also

seem to assign a much more important and significant role to the transitional variations resulting from the interactions of consecutive sounds than we have tended to assign to them when we have operated on the assumption that speech can be quantized into independent units.

It therefore seems evident to this writer that, in our continued search for the significant acoustic characteristics of speech which provide cues to its perception by listeners, we need to examine carefully the assumptions which are basic to the analytical methods that we employ and that a reevaluation of these assumptions may tend to force us into a more dynamic, less cross-sectional, approach to our problems. This seems particularly true with respect to the analysis of consonant characteristics, but it may also be true to some degree of the analysis of vowels.

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Systematic Research In Experimental Phonetics: 4. The Evaluation Of Speech Signals

Gordon E. Peterson

IN RECENT times, experimental phonetics has found its general objectives in the operational description of the speech processes. Equipped with the methods of mathematical logic, with the principles of communication theory for the physical analysis of signal structure, and supported by modern experimental, instrumental, and statistical techniques, the field is in a position to make rapid scientific progress.

In a diagram similar to that employed in previous papers (*13*), the speech processes are shown very schematically in Figure 1. The four diagrams represent four separate individuals and the joining lines represent simple communication links between them. The aural and the visual feedback paths are shown as AF and VF. Also shown is the internal neural feedback from the mechanism to the brain. It is the purpose of this analysis to comment very briefly upon the general nature of the speech communication processes, and to emphasize some of the major problems which yet obtain in their description —a description which the speech scientist seeks to make quantitative, of course.

The task is the operational description of the speech processes, both normal and pathological, in the various speech situations, conversation and the arts. For practical reasons, at the present time attention is directed primarily at the elementary communication situations, with more emphasis on that portion of the distribution which is considered normal speech.

It is about the systems which are most readily accessible to experimental observation that most information concerning the speech processes is available. These are the motor-acoustical and the acoustico-sensory transformations, indicated by the peripheral areas on the diagram.

Motor

It has long been recognized that there are two major aspects to the production of tone by the human vocal mechanism. On the one hand, there is the generation of tone or excitation, and on the other hand there is the resonation or shaping of these tones by the cavity structures. Primarily the generation of tone in vowel-like sounds occurs at the larynx, but when we consider con-

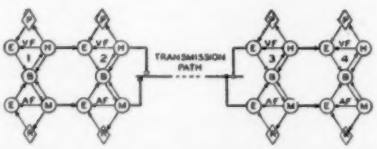

FIGURE 1. Communication linkages. B-brain, E-eye, ear, M-mouth, H-hand, R-recorder, P-page.

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sonants as well, the generation of tone may occur almost anywhere along the vocal tract. The vocal cords, the epiglottis, velum, tongue tip, or lips may be vibrated. Friction producing constrictions may be set up almost anywhere along the length of the tract. Shock and edge tone excitation may be set up at various points within the mechanism.

In the acoustical output wave from a system so complex and so varied as the human vocal mechanism it is difficult to separate out the source excitation from the resonance properties, transmission characteristic, or system function. A complicated transformation is obviously involved in the conversion of the physiological structures and movements into acoustical waves. Only within certain limits is it possible to assume that for every condition of the mechanism there occurs a corresponding and distinct acoustical pattern. (a) The correspondence obviously becomes less exact as the mechanism or portions of it degenerate into silence for longer and longer periods of time. (b) Sublaryngeal mechanisms can only be represented very crudely at best. (The work of Stetson has provided considerable information about the nature of the correspondence which may be observed.) (c) The degree of correspondence which can be observed decreases as extraneous noise increases in level to obscure the signal. (d) The nature of the correspondence which may be observed between the physiological mechanism and the acoustical waves depends upon the range of frequencies over which the observations of the mechanism and the acoustical waves extend. For example, if only the first one or two formants of an acoustical vowel structure are determined, then the details of the cavity formation may be varied considerably without altering these formant positions in frequency.

When we consider the above factors along with the tortuous forms which the resonating cavities may assume and also the complexities of tone generation all along the vocal tract, then it must be recognized that quantitative and mathematical descriptions of the mechanico-acoustical transformation of speech are in a most elementary form.

Sensory

The acoustical signal which is generated by the vocal mechanism undergoes another complex transformation when it is converted from the sound wave into neural discharges within the cochlea. A great deal is known about this transformation, but the literature would lead one to believe that there is much which is as yet unexplained in any quantitative way about the conversion of acoustical vibrations into neural impulses.

There is, of course, no *signal* information which appears at the immediate output of the cochlea which is not available in the stimulating acoustical signal. The ear may add distortion or possibly it may add noise in other forms. In terms of signal data, however, the mechanism of the ear can only *transform* and detract, it cannot add information which was not present in the acoustical waves.

Once the signal is passed on to levels within the central nervous system where perception and signal *interpretation* occur, however, we may be sure that no simple correspondence exists between the acoustical waves and the neural impulses. For here the processes depend very much upon the previous experience of the organism. Of major importance, of course, is previous experience with signals similar to the one

presented for evaluation. Of considerable interest is the fact that information, often misinformation, which is not encompassed in the signal at all may be perceived by the recipient of the message. At this point it may be noted that there is little *experimental* information about the effect of an auditor's linguistic background upon his perception of speech signals.

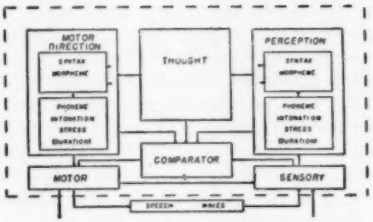

FIGURE 2. Conceptual model of the speech process.

Speech Communication Theory

It is the direction of the speech mechanism for symbolic expression and the interpretation of that symbolism after it has been transformed by the auditory apparatus of the listener which presents the most challenging problems to the experimentalist. A concept or theory of speech communication is required. As Dallenbach (*5*) recently wrote, 'Doing something without a theory is not scientific experiment. It is mere busy work.' And Boring in his recent article (*4*) writes: 'The hypothetical constructs pervade science. They are the stuff of which it is made.'

In the creation of hypothetical constructs experimentalists have probably justifiably been accused of attempting too frequently to deal with the CNS as a Conceptual Nervous System. It is probable, however, that in a complex process such as speech perception one must in part deal with a conceptual system, for it is highly improbable that structures are to be found in the central nervous system which correspond directly to the various aspects of linguistic structure. The interpretation of language undoubtedly involves a functional organization of the perceptual components of the central nervous system which is highly complex.

Figure 2 is presented as a highly speculative model of the communication process for reference in the following discussion. There are many aspects of speech communication which must be considered if an adequate model is to be constructed. The neuro-mechanical functioning of the motor and sensory apparatus is basic. *The acoustical signals which are produced are of necessity structured in terms of the organization and the capabilities of these mechanisms.*

It will be noted that the diagram is divided into two major divisions, sensory and motor; at a relatively low functional level is shown the comparator of the system. It is suggested in the diagram that language is structured essentially the same both in motor production and in perception. In the production of speech the CNS is directly concerned with the control of the motor mechanism, whereas in the perception of speech the CNS is directly concerned with the interpretation of acoustical waves. The space-time distribution of neural impulses within these two divisions of the system as speech is produced and as it is perceived must differ markedly. In speech production, however, at the level of the comparator these two neural impulse functions are in some manner brought together for combination in motor control.

On the motor side there is considerable reason to believe that one of the major basic symbolic units for speech

communication is an articulatory invariant of position or position and movement. On the sensory side this invariant becomes a set of relationships within the acoustical structure of the signal. There is evidence that the relationships in the perception of speech are somewhat more fundamental than the invariants of motor production: The interpretation of speech is developed somewhat in advance of its production—for we learn to speak from hearing the speech of others. An individual must interpret the speech of many, but he controls the mechanism of only one. Further, in the case of markedly defective motor mechanisms, speech perception which approximates the normal may none-the-less be developed. For these and other reasons there is some justification in the recent emphasis on acoustical phonetics.

At the level of directions supplied to the motor mechanism and at the level of auditory perception of the acoustical signal, the above indicated invariant becomes the abstraction of the phoneme. Due to the nature of the sensory-motor system one is thus led to postulate a perceptual phoneme as basic and a motor phoneme as somewhat secondary to it. The deviations which are observed in the speech of a given dialect primarily result from variations in mechanisms and mechanism control from one individual to another and from the marked effects forcibly interposed by articulatory abutting.

The concept of the phoneme has received serious study by students of linguistic theory over a considerable period of time. Early theories came from such men in Europe as de Saussure (*17*) and Trubetzkoy (*20*), and in this country from Sapir (*16*), Bloomfield (*3*), and Twaddell (*21*). More recently has been the work of Bloch (*2*), Trager and Smith (*19*), Harris (*10*), Jakobson (*12*), and of Hjelmslev in Copenhagen (*11*).

At the acoustical level there are approximately four prominent aspects to the speech wave: the spectral structure, the fundamental frequency of the periodic speech waves, the intensities which occur, and the time function or durations of these various parameters. Two types of phenomena appear in the spectral structures: the relatively constant components, such as those due to vocal cord defects or inadequate velar-pharyngeal closure, and systematically varied structures, such as those indicated by the formant frequency positions.

The acoustical stimuli generate patterns of neural impulses within the nervous system. The effects of the above named variables within the central nervous system in the case of speech are often referred to as pitch, loudness, duration, voice quality, and phonetic quality. These are grouped to form basic symbolic elements in language production and perception, as suggested in Figure 2.

There have been relatively few students of the linguistic functions served by intonation and stress. Notable among those who have worked in this field are Firth in Great Britain (*9*), Pike at Michigan (*15*); also, Trager and Smith (*19*) devote considerable attention to these aspects of speech.

It must be recognized that intereffects in both motor production and in perception are probably considerable, so that neither the motor directions nor the perceptions will have a consistent and direct correspondence in the physical structure of the acoustical wave. While language is very probably structured in such forms as those indicated above, redundancy in language is such that consistent and

complete symbolization is not required for normal intelligibility. Further, to some extent, the aspects of language function in a relative rather than an absolute sense. Intonation and stress may depend considerably upon contrasts within a single utterance rather than upon absolutes. There is little question but that a relativity is to be found in those aspects of the acoustical patterns which determine phonemic structure also. It must be noted, however, that phonemic relativity depends primarily upon cross-sections in the frequency structure, rather than in the time structure of speech. Unlike intonation or stress, phonemic structure depends little upon temporally immediate contrasts. Thus the magnitude of time sequence effects in the acoustic spectral relationships which determine phonemes is yet to be ascertained.

Experimental phonetics is concerned with the bio-physical nature or basis of the communication process (of the signs and symbols); this is much more, of course, than the study of 'pre-linguistic' data. Modern linguistics has been intently concerned with the internal structure or 'expressive-form' (as labelled by Hjelmslev) of the symbolization. Semantics, on the other hand, has been busy with the study of the relationships between the symbolization and the referents or the structures and relationships within the physical universe as represented by the signs. The three fields of study are obviously intimately related.

In the diagram the arrows are intended to suggest the general relationship of the morpheme and syntax structure of language to the basic elements of speech on the one hand, and to the perceptions of the external world on the other.

In order to illustrate the distinctions in these linguistic levels or hierarchies, let us consider the individual who speaks several languages. Such an individual may express what are essentially the *same ideas* with markedly different linguistic patterns of morphology and syntax. This same speaker may also employ the elementary signs or phonemes and prosodies which he conventionally employs in speaking one language as the symbols with which he expresses another. It is the mixing of systems from various languages, the use of the expressive-form of one language in speaking another which we normally recognize as foreign dialect.

It is generally recognized, of course, that because of various types of noise and error the linguistic forms are rarely complete or fully coherent. Because the organism must constantly interpret signals under a great variety of conditions, it is accustomed to constructing information at these levels on the basis of limited evidence from preceding levels. The probable correctness of the assumptions increases with the redundancy in each level and decreases as a function of interfering noise. It must be recognized that each of these levels is not to be found at a full level of consciousness as one speaks or attends to speech.

Now in the constructs of linguistic theory lies a major challenge to those who would study the processes of speech. Is it possible to find within the central nervous system activities which correspond in their occurrences to the occurrences of phoneme and morpheme reception during the actual listening process? Certainly in animals or in the human who is not consciously perceiving the speech we cannot expect to find such activity, for the level of phoneme interpretation of the speech signal is something which clearly extends well beyond

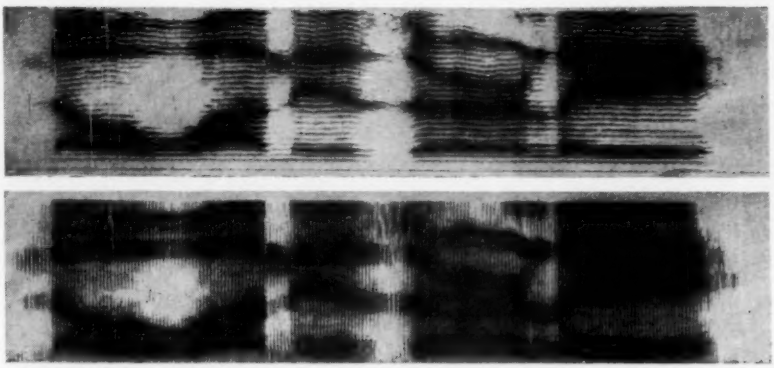

FIGURE 3. Narrow and wide band, 3500 cps spectrograms of 'No one is early.'

the ordinary acoustico-neural transformation of the ear. Likewise we may inquire whether it is possible to observe neural activity in the motor production of speech which corresponds to the phoneme structure being emitted.

Acoustical Analyses

Since the acoustical signal is very much more available than the mechanism which generated it or the outputs of the individual nerve fibers emanating from the cochlea, and since all of the physical information is available in the acoustical wave, there has been a pronounced emphasis on the study of the acoustical structure of speech in recent years. As a result, considerable information has been accumulated about the manner in which speech sound generation occurs and about the manner in which the intelligible structure of speech is derived from the acoustical characteristics of the signal.

It is known that there is no simple and direct correspondence between the acoustical structure of speech and the interpretations which are made of that structure. Of major importance is the personal experience, the stored information, which one brings to the interpretation of the speech signal. Secondly, speech mechanisms differ so radically that constant spectral structures are hardly to be anticipated and it is now well known that they do not exist in speech. A third very fundamental factor is that known as assimilation in speech production; the inter-effects in the position sequences of articulation are marked.

The acoustical structure itself may be considered either in terms of correlation parameters or in terms of the frequency, amplitude, and time of spectrum analysis. A Correlatograph has been constructed at the Bell Telephone Laboratories, but thus far there is no information in the literature which shows auto-correlation to have any superiority over ordinary spectrum analysis in the display of speech signals (*1*).

In Figure 3 is shown an ordinary sound spectrogram of continuous speech. For illustration the pitch of the voice was held relatively constant in producing this speech sample. Both the wide and the narrow filters were employed in order to show in more detail the nature of the acoustical structure. It has been noted repeatedly

that the sound spectrograph was the first truly dynamic device developed for the analysis of speech. The almost continuously changing nature of the spectrum is obvious in these patterns. In general, there are positions, particularly in the vowel-like portions of the spectrogram where the spectrum changes as a function of time are slow, and there are other positions where the changes appear almost abrupt. In a mechanism of this sort one would rarely expect to find idealized acoustical forms. According to the principles of Fourier there are no pure tones in speech. Likewise, in mathematical idealization, there are no true transients or pulses in speech. What we actually have in the acoustical waves of speech are varying degrees which lie in between these two extremes. These various forms all contribute information of a fundamental nature.

While sustained vowels and most sustained consonants (excluding the plosives and clicks, of course) are highly intelligible, there can be little doubt that the pointing or movement of the formants aids considerably in defining them both in continuous speech. Quantitative descriptions of these movements have been presented previously by the present author and others.

One must not conclude from the above, however, that specific rates of change are fundamental to the definition of any given phoneme. Fairbanks' work with time compression and expansion (*7*, *8*) has well demonstrated the elasticity of the time scale in speech. Further, when the same vowel is associated with different consonants or the same consonant is associated with different vowels, the formant rates of movement may differ radically because of the distances over which the formants must move in frequency.

In view of these considerations it is clear that both sustained positions and transients are of fundamental importance in speech perception. The observation by Fairbanks (*6*) that the sustained values represent the control points or target positions and that the movements present the error signal in the servo process is a contribution of fundamental importance to the understanding of speech. Recent implications that the invariants of speech are to be derived *primarily* from transient properties would appear to be very much out of focus. The suggestion that experimental phoneticians are only now beginning to deal with the movement aspects of speech signals is little more than an autobiographical expression of ignorance of the literature. Anyone taking this view obviously has not read the work of Rousselot, Scripture, or Stetson; recent work in acoustic phonetics by such men as Joos, Delattre, and Fairbanks contains frequent references to both the dynamic and the sustained aspects of the speech signal.

Experimental evidence previously published indicates that for the vowels the fundamental regions are those where the formants change most slowly as time progresses. The effect is illustrated in Figure 4. The two upper spectrograms in this figure were spoken by a man and the lower two by a woman and a child, respectively. In all of these a sustained vowel was formed, next a series of syllables containing that vowel was spoken rapidly, and then the vowel in isolation was formed once again. In some instances the vowels appeared to differ phonetically, but phonemically, of course, they were the same for any one spectrogram. An examination of

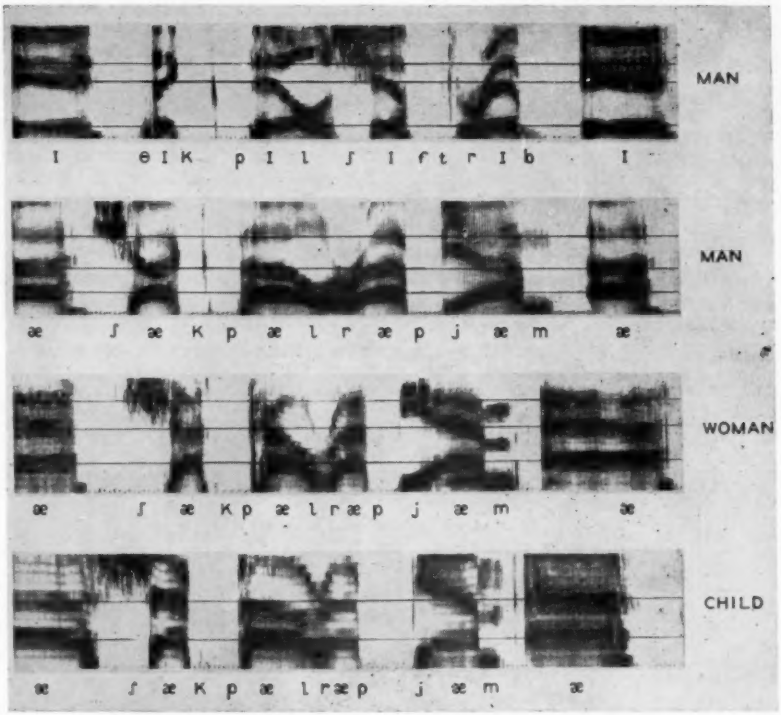

FIGURE 4. Wide band, 3500 cps spectrograms of vowel-syllable sequences by three different speakers.

these spectrograms will show that in general the sustained vowel positions are approximated in this group of syllables where the rates of spectrum change are the slowest.

That sustained vowels have a reasonably high intelligibility has been indirectly observed in many experimental studies extending well into the past century. A study reported at a recent meeting of the Acoustical Society of America by Hirsh confirms these observations. We now have available, in addition, the very excellent study by Tiffany (*18*).

Approximately 15 years ago the present author reported a study in which sustained vowels were reproduced over a loudspeaker. A shorting switch controlled the time interval

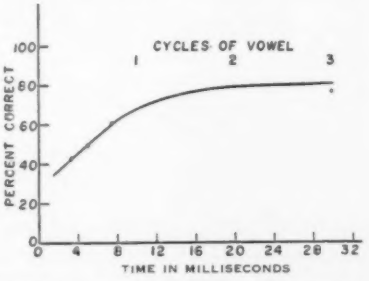

FIGURE 5. The intelligibility of short sections from vowel sounds.

during which the signal was supplied to the loudspeaker. Typical results of this experiment are shown in Figure 5. The loudspeaker was shorted, except for the brief time intervals indicated. Since oscillograms were made of the voltage at the speaker terminals, the durations were observed with considerable accuracy. Thus these intervals indicate the true durations from which information was extracted from the speech wave. The heard signal was undoubtedly longer due to room reverberation. The vowels were produced by a male over a microphone, and 20 subjects were employed. Eight different General American vowels were used. The fact that the curve levels off in the region of 80 per cent correct is probably due to several causes associated with the experimental conditions.

More recently another experimental study of vowel recognition was carried out. In this experiment three different speakers were employed. The [h-d] word list containing 10 different vowels (*14*), as previously reported, was recorded by these speakers. These same speakers also recorded the 10 vowels in sustained form. The endings were then removed from copies of these recordings. The vowels were also synthesized on the Wente tone generator (*22*). One synthesis included har-

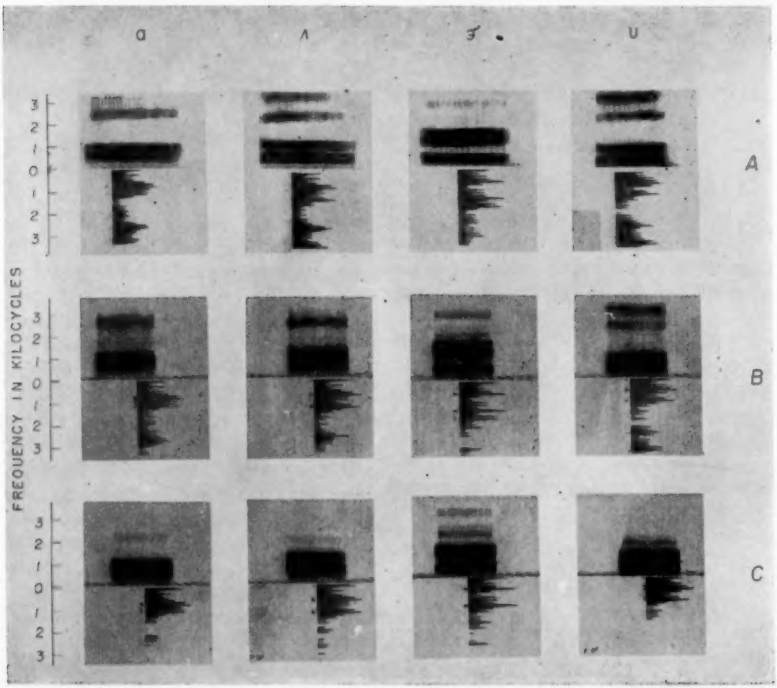

FIGURE 6. Spectrograms and amplitude sections of four vowels by the speaker of Figure 7. A-normal vowel, B-synthesized, C-synthesized through the second formant.

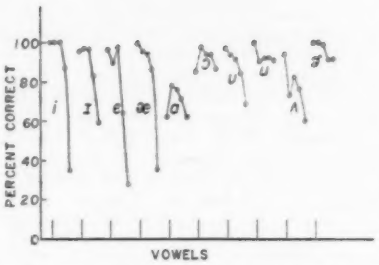

FIGURE 7. Speaker A. The intelligibility of vowels under the conditions of: normal syllable, normally sustained vowel, normally sustained vowel—endings removed, synthesized, synthesized through the second formant.

monics up to 3500 cps, and a second included accurate synthesis only through the second formant; the third formant was omitted or greatly reduced in amplitude.

Altogether there were five different conditions of test: The [h-d] words, normally spoken vowels, vowels with the endings removed, synthesized vowels, and synthesized vowels with the third formant reduced in amplitude or removed. The vowels with the endings removed and the synthesized vowels were approximately 0.3 second in duration. The [h-d] lists were presented on different days from the vowel tests. The four vowel conditions, however, were presented at a single session to a group of 67 observers. There were two lists of 10 vowels each by three speakers under these four conditions. This made a total of 240 individual samples which were arranged at random for presentation. A complete set of spectrograms was made of the artificial samples which were presented to the listeners in order to check the accuracy of the synthesis. Of the 120 vowels synthesized from recorded tones it was found that the fundamental frequency corresponded to that of the original utterance in $\pm$ 2 cycles in 78 cases; $\pm$4 cycles included 102 cases; and a more serious deviation was found in the remaining 18 samples. Examples of the type of synthesis which was carried out are shown in Figure 6. This figure shows spectrograms and amplitude sections for the original utterance and for the two synthetic vowels. The spectrograms of the normal vowels and of the synthesized samples were made at different times and the frequency equalization of the spectrograph was somewhat different in these two sets of analyses. The four vowels shown in Figure 6 were selected from those for the speaker of Figure 7.

The data for the three speakers are shown in Figures 7, 8, and 9. For each vowel the data are arranged in the

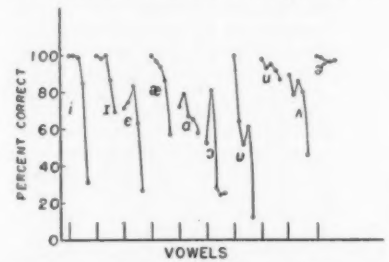

FIGURE 8. Speaker B. The intelligibility of vowels under the same conditions as for Figure 7.

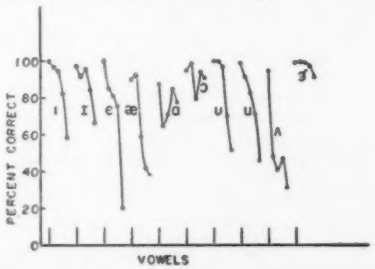

FIGURE 9. Speaker C. The intelligibility of vowels under the same conditions as for Figure 7.

order [h-d], normally sustained, normally sustained-endings removed, synthesized, and correctly synthesized through the second formant only.

The high intelligibility for certain of the synthetic vowels and for the case of the very short vowels of the previous experiment obviously is neither based upon initiation and termination effects nor upon some sort of wobble in the vocal cord period. One of the prominent results of these data is the effect of the third formant upon vowel quality. The interpretation here does not give prominence to the third formant alone, but rather emphasizes the fact that the higher formants do contribute to vowel specificity. There are many important studies yet to be carried out on the effects of formant movements upon speech perception. There are certain other problems of very great importance for which the sustained vowel or consonant offers by far the most practical test signal.

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A New Instrument For Detecting The Galvanic Skin Response

Kenneth C. Stewart

THE GALVANIC skin response is being used in many areas of research concerned with sensory mechanisms. The discovery of the GSR is usually attributed to Féré about 1888. In simple terms, if a unidirectional current, a galvanometer, and the palmar regions of a human subject are connected as a simple series electric circuit, various galvanometer current-time relations will be observed. The changes in current, with time, are caused by changes in skin resistance. The exact mechanism responsible for the resistance change is unknown. It is known, however, that many external stimuli and many internal stimuli can produce the change. Interest in GSR technique is particularly widespread in the field of audiology because, in connection with controlled acoustic stimuli, it offers a possible objective measure of auditory sensitivity.

The GSR, however, has inherent disadvantages. Resistance level is constantly shifting, and the measured terminal response can be triggered from a host of stimuli. Thus, a response following presentation of a controlled external stimulus is not necessarily due to the stimulus. Synchronism, or near synchronism, with other stimuli is always possible. Both these factors act to reduce objectivity in GSR studies.

Many instruments have been devised to improve objectivity in GSR technique. The most common instruments are modifications of a d-c amplifier in conjunction with a resistance bridge. Such instruments respond well to skin resistance change, but have two main disadvantages: (1) Bridge balancing controls must be manipulated to keep the needle of the recording instrument on the chart paper, and (2) the amplifier is capable of responding to other phenomena which have 'time rates of change' outside the limits of the GSR, such as muscle movements.

These two factors increase 'background' and in a sense mask the GSR. A sample of record taken on one type of conventional instrument and illustrating these points is shown in Figure 2. The letters on the figure indicate GSRs. The numbers indicate needle sweeps caused by bridge balancing. Constant 'creeping' of the recording needle is also evident.

Since the GSR offers a potentially objective measurement method, it would appear useful to examine the GSR in some detail with the purpose of designing an instrument that would isolate GSRs from the background and eliminate, or greatly suppress, other responses. *The technique would be further improved if manipulation*

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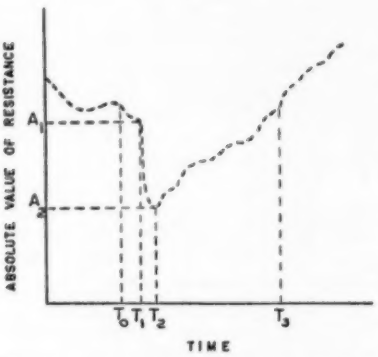

FIGURE 1. Typical absolute value record of resistance change with GSR utilizing a resistance bridge, d-c amplifier, and cathode ray tube. The order of magnitude of time from T_0 to T_2 is one minute. The order of magnitude of the difference A_1 minus A_2 is variable and was not determined for the response shown. In general, this difference is from 100 or 200 ohms to 6,000 or 8,000 ohms.

of balancing controls could be eliminated.

A feasible method of examining the GSR is to attach a cathode ray tube to a d-c amplifier and resistance bridge. This arrangement will provide an instantaneous description of the terminal response. Having thus described the phenomenon, specific attributes can be selected for measurement purposes. Attributes that are observed utilizing such instruments follow:

1. Approximately one to three seconds elapse between the onset of an external stimulus and GSR. This is the latent period.
2. When the GSR starts, the skin resistance decreases maximally in about one second.
3. Following the initial decrease in skin resistance, there is a period of recovery that requires approximately one minute.

The general pattern of resistance change is shown graphically in Figure 1. The stimulus is presented at T_0. At T_1 the GSR starts. That part of the graph from T_1 to T_2 is the initial drop in absolute value of skin resistance. At time T_2 recovery is essentially complete.

The response as depicted in Figure 1 is representative of the ideal case. The bridge circuit is well balanced and the subject is resting quietly prior to the stimulus. A more realistic situation as it occurs in the clinical application is shown in Figure 2. In addition to variations due to stimuli and movements, there are superimposed many bridge balance corrections. The resultant chart record is very complicated, and GSRs to any presented stimuli are so intermingled with other background that an attempt at objectivity from such a record is extremely difficult.

If the GSR gives the essential information, there is no need for accepting such a complex record. An electronic

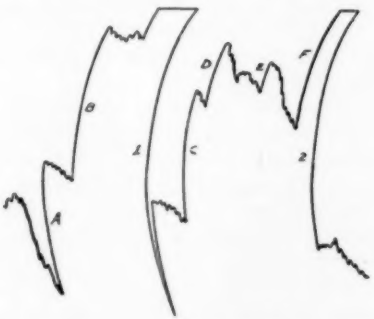

FIGURE 2. Segment of typical clinical record obtained using absolute value recording apparatus and resistance bridge. The tracing needle moves from left to right and the time of tracing is approximately one minute. Galvanic skin responses are indicated by A, B, C, D, E and F. Necessary manual bridge balancing deflections are indicated by 1 and 2.

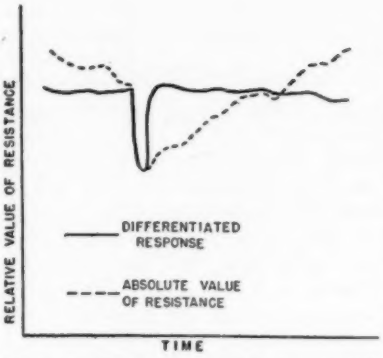

FIGURE 3. Absolute value of resistance and resulting differentiated response obtained on the new GSR detector.

amplifier can be designed which responds only to the initial drop in skin resistance: the value, A_1 minus A_2, in Figure 1. The long recovery change in resistance can be excluded by an electronic differentiation circuit.

The effect that a differentiation circuit will have upon the generalized response of Figure 1 is shown in Figure 3. (The generalized response is shown dotted and the differentiated response is shown by the solid line.) It is to be noted that the GSR, shown in Figure 1 as a change in absolute value of skin resistance, now occurs as a well-defined pulse stemming from an arbitrary base line. This happens because the differentiating circuit responds only to transient phenomena which have a specified rate of change with time. (The circuit can be designed so that it is incapable of responding to slow drifts of skin resistance.) It is important, however, to set the lower limit of the time rate of change passed by the differentiator below the GSR rise time. If this is not done, GSRs will pass undetected.

Additional suppression of the background can be accomplished in two ways: (1) Eliminate the resistance bridge, and (2) insert a low pass filter that has an upper cut-off well below the type of response coming from rapid muscle movements.

The bridge circuit can be eliminated by designing an input circuit that does not require adjustment to the individual subject. A possible circuit is shown in Figure 4. Examination of this circuit illustrates its feasibility. The fixed resistor (R), in series with the battery (E) and the subject, limits the current through the subject to a small value and makes a resistance change in the subject appear as a voltage change across the circuit combination C_1R_1, C_2R_2. C_1R_1, C_2R_2, forms a filter for suppressing higher frequency transients (such as the rapid muscle movements referred to earlier).

The voltage across R_s as a function of the battery (E) and the resistor (R) is

(1) $$E_{R_s} = \frac{ER_S}{R_S + R},$$

E_{R_s} = voltage across subject.

(2) $$dE_{R_s} = \frac{ER}{(R_s + R)^2} dR_S,$$

R_S = absolute value of subject's resistance,
R = fixed resistor,
E = battery voltage.

It is noted that the value dE_{R_s}, the change in voltage across the subject, depends upon both R_s and R.

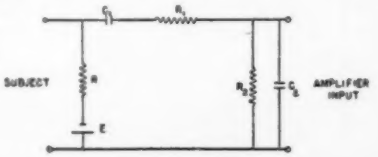

FIGURE 4. Input circuit of new GSR amplifier.

R is non-variable, therefore its value must be carefully chosen. Rewriting equation (2) as

$$(3) \quad G(R) = \frac{KR}{(R_s+R)^2}, \qquad K = (E)\,(dR_s)$$

enables this choice to be made, i.e.,

$$(4) \quad \frac{dG(R)}{dR} = \frac{(R_s+R)^2\,K - 2KR(R_s+R)}{(R_s+R)^4}.$$

To maximize, set

$$(5) \quad \frac{dG(R)}{dR} = 0.$$

This gives

$$(6) \quad R = R_s.$$

For a given value of R_s, a maximum change in input voltage occurs only if $R=R_s$. For any other condition between R and R_s the input voltage is reduced in magnitude. Clearly this can result in a serious situation, for a response might occur and pass undetected.

A generalized curve trace of the function G(R), shown in Figure 5, enables a proper choice of R. For example, suppose when beginning the GSR test one sets the value of $R=R_s$.

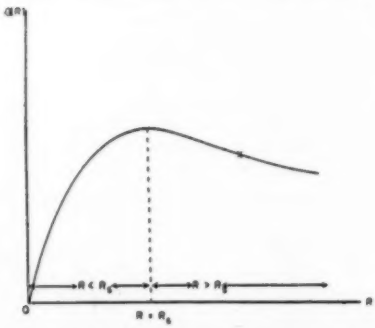

FIGURE 5. Generalized curve trace of the function G(R).

FIGURE 6. GSR recorded on new instrument.

(This can be done by measuring R_s with an ohmmeter and then making the adjustment $R=R_s$.) The condition at this instant is as shown in Figure 5; that is, G(R) is a maximum. It is known that as a subject becomes accustomed to the test situation his resistance usually increases. Under this condition, R soon becomes less than R_s, and the operating point is somewhere between the maximum value of G(R) and zero. If R is set initially greater than R_s, the operating point is located on the curve to the right of $R=R_s$, at some point X. Now, as subject resistance increases with adaptation to the test situation, R_s will approach R. If the value of R is made initially great enough, a desirable condition—R approximately equal to R_s—will exist. When R is not equal to R_s, there is a loss in sensitivity, but amplifier gain more than compensates for the slight loss due to this cause. In a final design, R is set at a value dictated by the working range of skin resistance. A value of 500,000 ohms is satisfactory for the adult.

A marked simplification of the chart record was obtained when the features discussed above were incor-

FIGURE 7. Typical segment of test record obtained on new instrument in the clinical application. The primed letters are GSRs due to various stimuli.

porated in a final instrument. The simplification is indicated in the recorded response of Figure 6. Again, the response shown is the ideal case taken from a resting subject. Responses obtained in the clinical application are shown in Figure 7. Here GSRs, indicated by the primed letters, are due to limb movements, breaths, thought processes, acoustic stimuli, etc. All these GSRs must appear, otherwise GSRs to a specific stimulus would not exist.

This instrument as described has been employed in research and clinical studies since 1951. Continuing use of this GSR detector has demonstrated its simplicity and ease of operation in practical applications. Because the instrument requires no adjustments after the initial gain-control setting, the operator is free to devote full attention to the test situation.

It can be seen, therefore, that the instrument has certain definite advantages that are lacking in older instruments. It is selective to the GSR, requires no manipulation during use, and provides a chart record that is easier and more positive to analyze than the record obtained on previous instruments. Even though the instrument does simplify the recording of GSRs, however, it must be emphasized that the instrument, alone, does not give complete objectivity to the technique in the study of hearing sensitivity. Such objectivity will come about only through the application of the instrument in a proper experimental method.

A first step toward making such studies objective has been taken. Two research projects utilizing the above instrument (*1*, *2*) have been completed and are reported in this issue. Further research is being conducted to examine some aspects of conditioning in GSR techniques.

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Some Basic Considerations In Applying The GSR Technique To The Measurement Of Auditory Sensitivity

Kenneth C. Stewart

IN A PREVIOUS article (*4*), the adult galvanic skin response was defined and an instrument was described which detects and records the GSR. The purposes of this paper are (1) to point to basic problems that exist when the GSR technique is applied to measure responses to acoustic stimuli, and (2) to show how the instrument is employed to solve some of these problems.

The GSR to acoustic stimuli offers a *potentially* objective method of assessing auditory sensitivity (*1, 2, 3*). In spite of inherent objectivity offered by the method, however, many problems arise in the clinical application that make the GSR technique, in fact, highly subjective. These problems may generally be classified as peripheral and basic. The peripheral category includes electrode placement, patient handling, reduction of unwanted stimuli and conditioning. Additional side factors are instruments, electrode types and electrode jelly.

A basic problem emerges from the consideration of the nature of the galvanic skin response. The GSR has not yet been shown to be specific to an acoustic stimulus—that is, the measured end product in GSR technique seems to have the same characteristics when triggered from many external and internal stimuli. These stimuli include limb movements, deep breaths, thought processes, tactile, startle, light and acoustic. Clearly, if one of these stimuli occurs simultaneously or almost simultaneously with the presentation of the acoustic stimulus, the resultant response may be due to any one of them. Thus, the possibility of obtaining *chance* responses to presented acoustic stimuli raises a fundamental question in GSR hearing sensitivity studies: *Can GSRs to acoustic stimuli be distinguished with a high degree of certainty from GSRs resulting from other stimuli?* It was seen that a procedure was needed for rigorous investigation of this question before the GSR technique could be developed for general clinical usage.

The important elements included in this investigative procedure are described below:

1. Conditioning Criterion and Maintenance of Conditioning. It is generally known that GSRs to acoustic stimuli alone cannot usually be maintained. Therefore, conditioning is employed to force responses to presented tone stimuli. One widely used stimulus for conditioning is an electric

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shock. In general, when a tone is presented to a subject, followed by a pulse shock as the tone terminates, one of at least three possible events can occur: (1) The subject may respond to both the tone and shock, (2) the subject may respond to the shock only, or (3) the subject may not respond at all. (This is in atypical case and will not be discussed further.)

An illustration of events 1 and 2 above is shown in Figure 1. Certain identifying marks appear on this figure. Sharply rising 'pips' are seen at the left of the tracings. These are calibration marks that denote the onset of a four-second tone stimulus. Marks on the straight lines at the bottom of the graphs denote pulsatile shock presentations of approximately one-half-second duration.[1] Time relations are such that the shock occurs four seconds after the tone pip. The tracing needle moves from left to right.

The first presentation of tone with shock, Figure 1(a), shows a large GSR spaced a given distance to the right of the tone presentation pip. In Figure 1(b), several tone-shock presentations later, the GSR has moved a small distance toward the tone calibration mark. This shift can be considered the result of a beginning anticipation of shock when the tone is heard. Figure 1(c) shows a further closing of the pip-response distance. From Figure 1(d), it can be inferred that the subject is probably working at a high level of anticipation. The rationale for the response follows: the subject first hears the presented tone at the instant indicated by the timing pip. He is immediately motivated and after a certain latent time, the small GSR, number 1 on Figure 1(d), occurs. The larger GSR, number 2 on Figure 1(d), has a certain latent time following the termination of the tone. Since the shock, whenever it is given, follows the tone, the larger GSR is believed to result from a greater anticipation on the part of the subject that a shock is coming when the tone terminates. As conditioning becomes more and more fixed, this anticipation causes the GSR to move closer to the start of the tone until finally a limiting value, set by physiologic delay time, is reached. This is shown in Figure 1(e) and (f). For purposes of this study the continuing

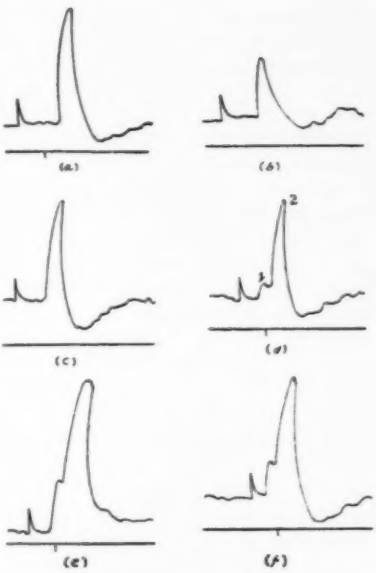

FIGURE 1. Typical responses obtained during the conditioning procedure; (a) is the first tone shock presentation, (b), (c), (d), and (e) are interim responses that occur as the subject is brought to conditioning criterion, (f) shows a response that meets the conditioning criterion. The numeral 1 on (d) shows a GSR occurring before response to shock, indicated as numeral 2.

[1]The shock was produced by a 60-cps source controlled by a General Radio Variac.

occurrence of the response as illustrated by Figure 1(f) was arbitrarily chosen as the conditioning criterion.

It is important not only to establish conditioning but to maintain it for long periods and, for this purpose,

TABLE 1. Randomized schedule indicating time and type of presentation. Included on this schedule are tones, shock and control stimuli as well as time intervals.

Item	*Shock*	*Intensity (db)*	*Time Between Presentations (Seconds)*	*Item*	*Shock*	*Intensity (db)*	*Time Between Presentations (Seconds)*
1		30		24		C	
			70				20
2		10		25		C	
			65				90
3	S	10		26		10	
			90				95
4		10		27		30	
			35				100
5		30		28	S	10	
			50				55
6	S	30		29	S	30	
			55				45
7		30		30		C	
			85				95
8	S	10		31	S	10	
			90				60
9		C		32		30	
			50				85
10		C		33	S	30	
			35				55
11	S	30		34		C	
			30				85
12		C		35		C	
			90				85
13		C		36		10	
			95				95
14		30		37	S	30	
			55				95
15	S	10		38	S	10	
			45				60
16		C		39	S	10	
			30				90
17	S	10		40		10	
			95				95
18	S	30		41	S	10	
			75				95
19		C		42		C	
			30				100
20		C		43	S	10	
			30				60
21		C		44		30	
			65				45
22	S	30		45		C	
			20				
23		30					
			30				

partial reinforcement may be used. The partial reinforcement schedule of tone-shock presentations used in this experiment is shown in Table 1.

2. *Control.* A control is usually employed when an experimental design is formulated to test a given hypothesis, so that data gathered in the course of an experiment will be as unbiased as possible.

One of the major problems in GSR studies is the occurrence of large numbers of responses due to deep breaths, limb movements, thought processes, etc., even though test stimuli may or may not be given. It follows that *when a conditioned auditory stimulus is presented there can be no guarantee that a following GSR is caused by the tone. Close synchronism with another stimulus is always possible.* The probability of getting a partially synchronized response to the conditioned auditory stimulus that will fall within the expected latent period of response to the conditioned auditory stimulus is unknown. It is clear, however, that the test procedure, to be useful, must distinguish between responses from auditory stimuli and others. In this study some method had to be found that would identify these chance responses, otherwise there would be no sure way of knowing whether or not responses following tones were in fact due to the tones. A method was not found that would give reasonable certainty, on a single presentation basis, that a response following a tone could be attributed to that tone. Hence it was decided to give several tone presentations mixed in with several of another type of presentation, so that the expected number of chance responses to tones could be determined —that is, a control was to be employed.

If the tones and controls were given at random with respect to one another, and these at random with respect to time of presentation, then there would be an equal chance for a response from another stimulus to occur following either type of presentation. Mechanically, such a control was identical to a tone presentation except that the audiometer tone interrupter was depressed, and thus no tone was audible. Thus, in the aggregate, responses following tone and control presentations could be examined to determine whether or not any real latent-time difference existed between them.

3. *Presentation of Stimuli.* It was required that the procedure for presenting acoustic and control stimuli be carried out without bias. Therefore, the tones and controls were scheduled at random with respect to each other and with respect to a time of presentation. Since it was known that responses from other stimuli would occur by chance, this allowed an equal opportunity for responses from other stimuli to occur following either tone or control presentations. The number of randomized presentations of tones and controls was arbitrarily set at 15 each. This assured enough presentations to account for synchronized or partially synchronized responses to the controls.[2] A minimum time of 20 seconds between presentations was set to insure partial recovery of skin resistance following test stimuli. A maximum time of 100 seconds was set, in order to avoid possible loss of conditioning.[3] It should be noted

[2] A pilot study indicated that, on the average, three out of fifteen control presentations yielded responses that fell within the expected latent time of response.

[3] In this first study the maximum time was assumed and was based on best available information. Test results have indicated much longer times may be used.

that the minimum time was much longer than latent time of response. Hence, there was ample opportunity for a chance response to occur within the expected tone response time. The complete randomized tone, shock, intensity and time presentation schedule is given in Table 1.

The formal presentation of stimuli was arranged as follows: an audiometer, GSR amplifier, recorder and shock-producing device were wired into a cam-operated cycling apparatus. Each time a start button was depressed the cycling mechanism automatically performed the following operations:

1. Presented the auditory or control stimulus as required.

2. Put a characteristic mark on the recording chart at the instant a tone, or control, was given.

3. Gave a shock pulse, when indicated in the test schedule.

FIGURE 2. Sample of response obtained from a subject after he has met the conditioning criterion. The sharply rising 'pip,' to the left of the large response, is a marker that denotes the instant of onset of the tone stimulus. The small jog on the straight line at the bottom of the figure is the shock marker. The time from tone marker to shock marker is four seconds.

4. Operated a marker pen, which put a mark on the bottom of the chart paper, at the instant the shock pulse was given.

5. Held a synchronous motor circuit closed for one revolution.

An auditory or control stimulus was presented each time the cycling button of the apparatus was depressed.

A sample of the chart, illustrating a typical response to a pure tone auditory stimulus, after the subject had met the conditioning criterion, is shown in Figure 2. The identifying marks discussed in 2 and 4 are indicated.

4. Definition of Response. An objective method for defining responses to test and control stimuli was employed using the following arbitrary criteria: (1) Minimum response amplitude of five millimeters,[4] and (2) minimum response slope of 45 degrees.[5] Only responses which met these criteria were acceptable.

The next requirement was to establish a method for measuring the time interval between stimuli — whether tones or controls—and responses. Rules for making this measurement follow:

1. The acceptable response that met the above criteria was located and its initial point marked.

2. A vertical line was drawn through this point, of sufficient length to extend beyond the extremes of the tone or control presentation pip.

3. From the vertical line drawn in 2 above, a horizontal line (the latent distance) was drawn to the midpoint of the leading edge of the presentation pip.

4. The length of the horizontal line in 3 above was measured in millimeters

[4]The statistical treatment of test results will justify this choice.

[5]This was set by the electrical characteristics of the instrument.

TABLE 2. Typical raw data for one subject.

Tones		Controls	
Latent Distances in mm	Freq.	Latent Distances in mm	Freq.
3.5	1	5.5	1
4.5	1	6.5	1
5.5	5	9.5	1
6.0	9	21.0	2
6.5	10	27.5	1
7.0	1	34.0	1
7.5	2	35.5	1
9.0	1	44.5	1
		56.5	1
		60.5	1
		64.0	1
		67.0	1
		104.0	1
		128.5	1

and the value recorded in the frequency table.

This was done with each acceptable response that appeared on the record following either a tone or a control presentation. For convenience in detecting and measuring responses, a simple transparency was utilized which met the entire set of above rules. In practice, this transparency was moved along the record following a tone or control presentation until it located an acceptable response. Once the response was located, the verticle line mentioned in 2 above was drawn. Then the length of the horizontal line, indicating the latent time, was measured and recorded.

5. Statistical Evaluation. For each subject, two frequency distributions of stimulus-response distance were obtained, in one case following auditory stimuli and in the other, following controls. (Typical raw data are shown in Table 2.) These were considered as two population groups and were subjected to statistical treatment to determine whether or not they could have come from the same universe. The nature of the data indicated the use of the chi-square test since, by inspection, it is clear that in one group measurements were concentrated below 10 millimeters, and in the other,

TABLE 3. Chi-square calculation aid, four-fold with one degree of freedom.*

		Stimuli: Tones	Stimuli: Control
Observed Distance (mm)	$\leq$ 10	a Exp. = (a + c) p	b Exp. = (b + d) p
	> 10	c Exp. = (a + c) q	d Exp. = (b + d) q

*$p=\frac{a+b}{n}$; q=1–p; n=total observations; a=number of tone responses less than or equal to 10 mm; b=number of control responses less than or equal to 10 mm; c= number of tone responses greater than 10 mm; d=number of control responses greater than 10 mm; Exp.=expected number of observations in a cell; Obs.=observed number of observations in a cell; Chi-square$=(|\text{Obs.}-\text{Exp.}|-0.5)^2\Sigma\frac{1}{\text{Exp.}}$.

TABLE 4. Chi-square value for each subject.

Subject	*Chi-Square*
1	30.9
2	35.4
3	33.08
4	28.2
5	23.6
6	28.2
7	25.4
8	33.08
9	28.1
10	21.9
11	37.3
12	32.5
13	33.08
14	34.5
15	37.3

were scattered uniformly. For comparison, the frequency distributions of responses to tone and control stimuli were divided into two classes: (1) distances less than or equal to 10 millimeters, and (2) distances greater than 10 millimeters. This classification provided a chi-square test of one degree of freedom. The resulting four-fold table, used in aiding calculations, is shown in Table 3. The calculated values of chi-square for each subject are given in Table 4. Note that the smallest value of chi-square is 21.9.

The probability of getting a chi-square value as large as 10.827 when two populations come from the same universe is less than one in 1,000. The results in Table 4 therefore demonstrate that the method used in this experiment distinguishes GSRs following tone stimuli from chance responses with a high degree of certainty.

Test Subjects and Procedure

Subjects used were volunteer male and female college students from the University of Pittsburgh. Their ages ranged from 17 to 30. None of the subjects was acquainted with the test procedure or its purpose. Standard audiometric tests demonstrated that the subjects had normal hearing.

The test procedure was as follows: the subject was brought into the test chamber and seated in a comfortable chair facing away from an observation window between the control room and the test chamber. A set of electrodes was placed on the tips of the second and third fingers of the left hand, another set on the second and third fingers of the right hand. He was told that he would feel nothing in the fingers of his left hand. He was informed, however, that a small electric current would pass through the fingers of the right hand. It was explained that the current, at first, would not be felt, but that it would be increased in small steps until it became unpleasant. The subject was instructed to indicate when he did not want the shock to be increased further.

The electrodes to the left hand were standard EEG type and were filled with Cambridge electrode jelly prior to taping them to the finger tips. In addition, the finger tips were rubbed with the jelly to insure a good electrical contact to the skin surface. The electrodes to the right hand were simply two wires from which about two inches of insulation has been removed. The wires were coated with electrode jelly and taped to the inner surfaces of the proper two fingers.

A headband, with audiometer and dummy earphone, was then placed on the subject's head.[6] The final instructions were that no questions would be answered and that no talking was to

[6]The audiometer itself was located in the control room. A wire to the earphone passed through the wall.

FIGURE 3. A segment of test record selected at random, showing tone and control presentation pips and responses following them.

take place unless there was a request, on the part of the subject, to discontinue the test. The doors to the test chamber were closed, the amplifier gain control adjusted to detect GSR activity, and the test begun.

The formal test was very simple to administer. It will be remembered that a stimulus presentation was made each time the start button of a cam-operated device was depressed. The only requirement here was to begin with Item 1 of Table 1 and press the start button as dictated by the time intervals. According to Table 1, Item 1, the intensity dial of the audiometer was set at 30 decibels and the start button arbitrarily depressed. Seventy seconds later, with the audiometer dial set at 10 decibels, the button was again depressed. Sixty-five seconds later, with the audiometer dial remaining on 10 decibels, but with the shock switch turned on, another presentation was made. Thus the test continued until the subject met the conditioning criterion. When this was accomplished, the entire test schedule of Table 1 was repeated. A segment of test record selected at random from the total tests is shown in Figure 3. Again, it is interesting to note the many chance GSRs coming from the normal resting adult.

Discussion

This basic study was conducted to determine whether or not GSRs to acoustic stimuli could be distinguished with reasonable certainty from chance responses when the testing procedure employed was completely objective. Purposely, the subjects chosen for the experiment were an ideal group—that is, young adults with normal hearing acuity. It was reasoned that if the demonstration could not be carried out successfully for this group, then there would be little hope, for any age group, of formulating an objective test method utilizing the GSR.

The subjects selected were cooperative in that they rested quitely during the entire test; hence, external stimuli were kept minimal. Even so, three out of fifteen times (on the average) there were responses to controls which could not be distinguished from tone responses. Therefore, even for a presumably ideal group the probability is relatively high that a response following a tone presentation is simply due to chance alone.

It can be seen from the above that the type of subjects used contributed considerably to the high significance of test results obtained. Of more importance, this high significance was due to the rigid conditioning criterion employed and the method used to maintain conditioning. It was found, in fact, that if a subject failed to meet the conditioning criterion, his responses to tones were erratic and little confidence could be placed in test results. To clarify, failure to meet the criterion resulted in less than 100% responses to tones, while the prob-

ability of obtaining chance responses remained the same—about 20%. When mathematically evaluated it was found that the combining of these events shifted the significance of test results in the direction of no confidence. The need for a criterion, to ascertain whether or not a subject was conditioned, was then clearly evident.

By applying a criterion, and using an adequate control, as in the technique developed here, it is possible to determine whether the test can or cannot be used with any given subject. If, on the other hand, the GSR method is employed on a subjective basis—that is, without criterion or control—the test results will be largely in doubt, for almost surely chance responses will be judged as responses to tones.

While it was gratifying to note the marked significance of these particular test results, many subtle questions were raised during the course of the experiment indicating that other areas need exploration before GSR testing can be used generally.

One immediate problem is the matter of generalizing the GSR method to children. The intensity of shock required to cause the subject to meet the conditioning criterion and to remain conditioned through partial reinforcement is presumably more than the young child will tolerate. There is reason to believe too that the general test environment may lead to so many chance responses as to invalidate test results.

Even with adults another clinical problem will arise in the application of this technique. In this study, a shock was never given unless the subject heard a tone; however, in hearing sensitivity studies there will be times when a shock will be given although no tone is heard. It would seem that this would increase subject anxiety and increase chance responses. Again, presuming other things equal, test results will shift in the direction of no confidence.

Thirdly, the total length of time required to conduct the described test is 45 minutes, and is related to the significance of test results in that it permitted a large number of stimuli presentations for statistical evaluation. It is possible that the test time might be reduced somewhat, but at the present time no information is available to show how much of a reduction could be effected without materially influencing the significance of test results. This limits the immediate application of this technique for clinical usage.

Just how all the above factors can be reconciled in an objective technique for measuring hearing acuity in the audiology clinic is not yet known. It is felt that this study has merely defined some of the problems encountered in GSR hearing sensitivity studies, and that much more work needs to be done before a truly objective measurement method will be available to the practicing audiologist.

Summary and Conclusions

The purpose of this experimental study was to determine whether or not galvanic skin responses to a pure tone auditory stimulus could be reliably differentiated from chance responses. The experimental design employed conditioning criterion, controls and an objective definition of response in an over-all procedure that avoided subjective judgment.

Results indicate that, with the use of this method for the group tested, GSRs to acoustic stimuli can be discriminated from other stimuli with an extraordinarily high degree of significance.

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The Measurement of Hearing Loss In Adults By Galvanic Skin Response

Leo G. Doerfler

Catherine T. McClure

GALVANIC SKIN response audiometry has now been carried on clinically for approximately six years. The techniques originally reported in 1948 (*1*) are being increasingly employed without change.

In this usual clinical galvanic skin response test with adults the tester is called upon repeatedly to make crucial decisions. Although there are other clinical questions, four have caused concern regarding the techniques currently employed. Brief consideration of each of these questions is warranted:

1. At what frequency and intensity shall conditioning be carried on? Since the conditioned stimulus (pure tone) must be audible if conditioning is to be achieved, selection is customarily made, in the absence of other test data, of a relatively intense low frequency tone, usually 500 cycles at 80 db or thereabouts. Initial presentation of the tone without the unconditioned stimulus (shock) may or may not produce a galvanometer deflection judged subjectively to be a response to the tone. Numerous tone-shock presentations are then carried out until the tester judges subjectively that conditioning has been achieved.[1]

Experimentally this is known as constant stimulus conditioning when the intensity of the tone remains the same. There are sufficient experimental data on conditioning, however, to raise doubt as to whether keeping the intensity constant or varying it (variable stimulus conditioning) during conditioning is desirable for maximum resistance to extinction. This question is currently under investigation and results will be incorporated in a forthcoming report.

The current clinical method of conditioning raises another question of importance. There is strong doubt as to whether the shock should be presented after each tone presentation during conditioning or only a certain percentage of the time (partial conditioning). Again, there are data in the literature on conditioning to warrant investigation of this question, and such a study is in progress.[2]

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[1] It should be noted that the manner of presentation of tone and shock, i.e., duration of each, interval between each, etc., is of importance but cannot be accurately controlled in the usual manual clinical method of presentation.

[2] Preliminary examination of the data indicates that when resistance to extinction is used as the criterion, partial conditioning is significantly superior. This is in contrast to current clinical practice. In this study Meritser (2) employed 40% reinforcement.

2. When is conditioning achieved for purposes of testing? In current practice a patient is considered conditioned when one or more tone presentations without shock are followed by galvanometer deflections judged subjectively to be responses to the tone. The customary manual method of presentation of stimuli makes it very difficult to set up needed objective criteria for achievement of conditioning.

3. When shall a manual presentation of the pure tone be made? A reasonably complex graphic record of galvanic skin response activity emerges from the conventional d-c amplifier-bridge apparatus customarily employed. Since current practice requires that a subjective judgment of a possible response be made after each presentation of tone, it is customary to withhold manual presentation of a tone until the galvanometer needle 'settles down.' Stewart (*4*) has pointed out that even with his simplified instrumentation, cooperative adult subjects and relatively long periods between stimuli, he obtained synchronism of responses to control stimuli 20% of the time. It would appear that current practice of presenting a tone when the galvanometer is not deflected may bias results so that galvanic skin responses to other stimuli may be mistaken for responses to pure tones a substantial percentage of the time.

4. How is a galvanic skin response to a pure tone stimulus identified from the usual complex record? The galvanic skin response to an auditory stimulus is not unique in and of itself; it is different in no discernible way from a galvanic skin response to any other stimulus. Thus one can never come to recognize it, but can merely identify it, with a properly constructed procedure, from other phenomena at a certain level of confidence on the basis of its proximity to the stimuli. This is difficult to do, and customarily the tester using the manual method of presentation is forced to make a subjective judgment both as to whether a deflection of the galvanometer is or is not a response, and whether it is a response to the tone or other stimulus. In brief, latent period, minimum amplitude, slope, etc., need definition.

Pertinent Research

Stewart (*3*) has described the development of an improved instrument to detect galvanic skin response activity. This device is composed essentially of an a-c amplifier compensated for low frequencies, with a specially designed input and differentiation circuit. It was designed to respond selectively to the galvanic skin response and to discriminate against unwanted activity, usually of a higher frequency.

In a succeeding paper, Stewart (*4*) demonstrated that the galvanic skin response following a pure tone stimulus can be distinguished with a high degree of certainty (less than one chance in 1,000 of error) from chance responses in young adults with normal hearing. The experimental design provided for entirely automatic presentation of all stimuli, conditioned and unconditioned, to the subject, and automatic and instantaneous recording of both stimuli and responses on chart paper. This was accomplished by an arrangement which wired an audiometer, the improved galvanic skin response amplifier described above, the recording oscillograph and the shock producing device into a cam-operated cycling apparatus. At

no point did the experimenter enter subjectively into the test situation in determining when or how long to present either stimulus.

Rigid objective criteria were employed to determine achievement of conditioning and identification of responses. Controls were employed.

The Problem

Since it had now been demonstrated that, *using improved instrumentation and proper experimental design,* the galvanic skin response to a pure tone could be distinguished with certainty from other activity, the next step was to use this technique to obtain the threshold of hearing in hard of hearing individuals.

Subjects

Thirty subjects were chosen from the files of the Department of Audiology of the Pittsburgh Eye and Ear Hospital on the following basis:

1. An otologic diagnosis of bilateral or unilateral conductive hearing loss in the ear to be tested.
2. An air and bone conduction audiogram which showed the loss to be of a conductive type of from 30-70 db at 1000 cycles.
3. The above examination within a period of six months prior to the experiment.
4. A chronological age of 17-50 years.

Conditioning

The conditioned stimulus was produced by an audiometer whose adherence to Bureau of Standards calibration was checked by artificial ear at the Department of Audiology.

A pulsatile electric shock was used as the unconditioned stimulus. It was produced by a 60-cycle alternating current source whose intensity was controlled by a General Radio Variac.

The experimental procedure called for use of the Stewart amplifier and automatic presentation and recording of all stimuli and responses. In brief, each subject was conditioned to a 1000-cycle tone at 70 db above normal threshold. The technique consisted of constant stimulus conditioning (intensity remained at 70 db) and partial reinforcement (the tone was followed by the shock 60% of the time). A conditioning schedule which randomized the occurrence of shock, and a randomized time interval with a minimum of 24 seconds and a maximum of 56 seconds between tone presentations was used.

As the anticipation for the shock increased, the time-distance relation between the tone presentation calibration mark and the ensuing galvanic skin response decreased.[3] When each of a series of three consecutive tones produced an acceptable response, conditioning criteria were deemed met. This procedure required from five to 26 minutes.

Test Procedure

The presentation of test tones was carried out according to a test sched-

[3]The Stewart criteria (4) for defining a galvanic skin response were employed: A response had to be a minimum of 5 millimeters in height and at least a 45° slope to be accepted. Accurate and quick check of responses was accomplished by means of a simple transparency. Simplicity of obtaining this objective determination of acceptable galvanic skin responses may be illustrated by the fact that the 7-year-old son of one of the research associates on the staff at the University of Pittsburgh routinely identifies acceptable responses correctly using this transparency.

ule (Table 1). It consisted of a randomized distribution of 25 presentations of tones, five for each level of 30, 40, 50, 60 and 70 db re normal threshold, all at a frequency of 1000 cycles. All presentations were carried out automatically, with the tester initiating each presentation cycle at randomized time intervals of from 24 to 56 seconds. Partial random reinforcement (60%) was accomplished by following 15 of the 25 tone presentations by shock, as indicated.

The test required approximately 17 minutes and was carried out without interruption. The experimenter had no previous knowledge of the hearing of the subject being tested.

After completion of the test, a threshold for 1000 cycles was obtained with the same audiometer by standard audiometry. The test by standard audiometry was always given last to insure that the tester had no indication of threshold during the experiment.

TABLE 1. Test schedule of conditioned stimuli and reinforcement.

Presentation	*Intensity* of Tone*	*Shock†*	*Time‡*
1	60	NS	24
2	70	S	56
3	40	S	40
4	70	NS	32
5	70	S	40
6	40	NS	40
7	50	S	48
8	60	S	56
9	30	S	24
10	30	NS	24
11	70	NS	32
12	40	S	56
13	50	S	56
14	70	S	48
15	40	S	32
16	60	S	24
17	50	NS	32
18	30	NS	48
19	60	S	56
20	60	NS	40
21	40	S	56
22	50	S	32
23	30	NS	40
24	30	NS	48
25	50	S	

*Intensity level in db re normal threshold.

†S—Shock followed tone presentation; NS—No Shock followed tone presentation.

‡Number of seconds between presentation of tone and presentation of following tone.

Results

Galvanic skin responses which occurred within a range of zero and 10 millimeters between the mark of the tone presentation and the response were examined. Those which met response criteria (minimum of 5 millimeters in height and 45° slope) were tabulated after each level of tone presentation.

An arbitrary decision was made to count three acceptable responses out of five presentations for a particular intensity level as indication that the subject heard the tone at that level. The lowest intensity level of presentation at which the subject responded with three galvanic skin responses which met the criteria was accepted as the threshold of hearing.[4]

For each of the 30 ears tested in this experiment two determinations of threshold were obtained. One was from the galvanic skin responses obtained as described. The other was from responses to standard pure tone audiometry using the same audiometer. The data obtained from the two measuring techniques in the form of thresholds are shown in Table 2.

[4]An arbitrary choice of four acceptable responses out of five as a determinant of threshold would raise one threshold from 30 to 40 db and two thresholds from 50 to 60 db.

TABLE 2. Thresholds obtained by galvanic skin response and by standard audiometry.

Subjects	*GSR Threshold in db*	*Standard Audiometry Thresholds*
1	70	65
2	60	60
3	50	45
4	50	45
5	50	45
6	50	45
7	50	45
8	50	45
9	60	55
10	40	35
11	40	30
12	60	60
13	60	55
14	50	50
15	50	45
16	50	45
17	50	45
18	40	40
19	50	45
20	30	35
21	30	30
22	50	45
23	40	35
24	50	40
25	50	50
26	50	55
27	30	30
28	40	35
29	50	45
30	60	55
Mean	48.66	45.16
Difference between Means	3.5	

It will be seen by inspection that in every case the two thresholds were within a range of ± 5 db. Actually, the thresholds for the two measurements agreed within a range of ± 2½ db in 28 of the 30 ears, and within ± 5 db for the remaining 2 ears. Table 3 shows the agreement of thresholds in relation to threshold level obtained.

This fact is of special interest, since two factors were at work to mitigate against this agreement. First, two differing psychophysical methods of obtaining a threshold determination were employed. In standard audiometry essentially the 'method of limits' is employed. In the galvanic skin response technique herein described the 'method of constant stimuli' was employed. In addition, 5 db steps were employed with the standard audiometric procedure, while the experimental design called for 10 db steps in presentation of stimuli in the galvanic skin response technique.

Summary

The 1000-cycle threshold of hearing for adults with conductive hearing loss can be determined in an objective manner by improved instru-

TABLE 3. Agreement of threshold for hearing obtained by galvanic skin response and by standard audiometry.

	Number of GSR Thresholds in db re Normal Threshold					
	30 db	40 db	50 db	60 db	70 db	*Total*
Cases Showing Lower Threshold for GSR Audiometry Compared to Standard Audiometry						0
Cases of GSR Thresholds Agreeing with Thresholds Found by Standard Audiometry (± 5 db)	3	4	15	5	1	28
Cases Showing Higher Threshold for GSR Audiometry Compared to Standard Audiometry		1 (10db)	1 (10db)			2

mentation and proper experimental design in the use of the galvanic skin response. Using this technique and objective criteria, it is necessary for the tester only to follow an appropriate schedule of presentation of stimuli. No subjective decisions or manual presentations need be made during the test, nor need the tester even see the patient. Certain questions involved in conditioning the galvanic skin response are raised, and suggestions for appropriate research made.

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A Visual-Tactile System Of Phonetical Symbolization

A. Zaliouk

THE MOST perplexing problem facing the speech therapist is a judicious choice of the tools to be used with the patient under treatment. Whatever the disorder of speech, whether a developmental failure, or a deterioration of already acquired normal speech, the proper understanding of the disorder depends upon a knowledge of the mechanism of speech in health and in disease.

The process of speech is essentially a system of symbolization producing sounds within the auditory range. Phonetics is concerned with the devising and use of a set of symbols to represent these sounds. The set of symbols of speech can then be evolved into a Phonetic System, which becomes the vital instrument in teaching speech to the deaf or congenitally aphasic child, in aphasic conditions of the adult, in the correction of defective speech, or in teaching standard speech in foreign languages.

Phonetic systems can be divided into two main types: the auditory systems and the physical systems. It is obvious that in speech rehabilitation or correction the auditory approach cannot be considered at all, or to a limited extent only, as the ear has failed in its task as the normal channel for speech development. Among the physical systems devised, some use the placement or position approach, others the kinesiologic or movement approach. The latter is closely related to the study of positions, but is mainly concerned with the movement necessary to produce that position.

For the deaf learning to speak, Alexander Graham Bell (2) worked out the 'Visible Speech' system to indicate the sounds as static positions that can be visualized. Nevertheless he also stressed the necessity of taking into account the articulatory movements as 'on and off glides' occurring between these positions, and he urged the teachers of the deaf '. . . to copy the natural process' in teaching words first and elements afterwards. He also realized the danger of the deaf child speaking in a defective manner, if the fixed positions were not taught to him precisely from the very beginning. But he did not go the step farther and draw the logical conclusion of fusing articulatory positions and movements into one system. With his genius for analysis, however, he did make this important statement:

> When two or more positions of the vocal organs are simultaneously assumed, the effect upon the ear is that of a *single sound*. Combinations of positions produce a sound of different quality to that produced by the component positions assumed separately.

Why then did he insist on reproducing in every detail the positions leading to the production of one single sound by a complicated graphic

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representation of a cumbersome algebraic sign?

Since Bell, little progress has been made in building up a simple and efficient phonetic system of symbols which could serve as a practical tool of work in everyday procedure in the hands of a speech clinician. The limited information we could collect revealed arbitrary methods of symbolization such as 'Langage Phonomimique' by Grosselin in France (*6*), and a 'Hand-Mund System' practiced by Forchhammer in teaching speech to the deaf in Denmark.[1] The Tadoma method, introduced by Alcorn (*1*) in which the feeling of vibrations plays an important and systematic part, has not modified the phonetic material in speech acquisition, using the elements according to the Northampton Vowel and Consonant Charts. And quite recently in a panel discussion, Magner (*8*), speaking of methods in teaching speech to the deaf as used in the Clarke School said:

> Both the synthetic and the analytic methods of approach are vital in order to help the deaf child develop oral communication as nearly like that of a hearing child as possible.

The lack of an appropriate, generally accepted and, above all, a practical phonetic system of symbolization, ready for everyday clinical work in speech therapy, incited us to search for a solution to this acute problem. Our phonetic system sprang mainly from clinical necessity, rather than from theoretical considerations. It was only later that we found it possible to consolidate our clinical findings by an abundant harvest of evidence collected through various scientific publications which dealt with related matter.

The prerequisites we believed essential to the establishment of a new trend in phonetical symbolization were as follows:

a. The system had to be an omnibus system, covering every field of applied phonetics, from speech rehabilitation and correction to acquisition of foreign languages.

b. It had to be a universal system easily adaptable to any language, of any etymological origin. (Colloquial Hebrew was the language in which it was originally devised.)

c. For this reason, and many others that we shall mention later, it had to be built on sound and well established physiological data, presuming that we have to deal with human individuals endowed with the same speech organs.

d. Such a phonetic system, having to respond to a wide variety of pathologic conditions, to individuals of any age and any origin, had to be very simple in its conception and easy in its execution, both to the patients and pupils on one hand and to the therapists and teachers on the other.

e. And finally, for didactic reasons, we had to find a mode of graphic representation that could easily be grasped and memorized both in class and in clinic.

We must admit that the magnitude of the task confronting us might well have prevented us from proceeding beyond an analysis of the needs. Having a medical education as a background, however, we were predominately guided by clinical considerations in our search for rapid therapeutical solutions. Thus we were liberated from the justifiable preoccupations that would have disturbed a scientist with a more thorough knowledge of phonetics.

In asking for indulgence, as lacunae are to be observed in this initial study, we must mention that we deliberately delayed publication of our system

[1] We could only judge the method by observing one of his pupils talk.

from year to year, until sufficient clinical data have been accumulated on the practical value of our work. Conceived some 15 years ago, the system has been applied for the past 10 years, both in our speech clinic and the Institute for the Deaf, which we founded in the fall of 1946.

In the aforementioned lines we have laid down the aims to be attained in evolving our phonetical system of symbolization. We will now attempt to explain the foundations and the materials we have used in building up this system.

In any process of rehabilitation or correction of a defective mechanism, the goal is to move away as fast as possible from the pathologic condition and to approach as nearly as possible the normal state. In brief, pathology must be replaced by physiology. What are the physiologic conditions of the mechanism of speech in action?

Stetson (*9*), in his remarkable study of speech in *Motor Phonetics*, insists on the basic fact of a common physiologic denominator in any spoken language in these terms:

> Independent groups of languages . . . present striking likenesses . . . The (special) mechanism of each language must be a specialized version of the general phonology which can be stated in *physiological terms*, [italics mine] independent of meanings. . . . articulation as the fundamental event in phonology, . . . figure[s] as signals and symbols in speech [which] must be . . . handled with reference to their actual function, in the processes of utterance . . . Articulate language involves the two phases: (1) A universal apparatus for speech common to all speakers; and (2) A specific, acquired language mechanism peculiar to the given language. . . . the apparatus for speech is universal; any child learns any language or pair of languages with the same ease.

The latter fact has already been taken into consideration by Trubetzkoy in a program of a general phonemics. We can thus affirm that a universal phonetic system of symbolization, as foreseen by Bell, is realizable. We can further establish the physiological data on which such a system can be built. When trying to analyze the normal speech process one is embarrassed by the controversial attitude of different phonetical schools of thought as to how to break up the over-all pattern of speech into its constituent parts. Without going too deeply into theoretical considerations, may we suggest that the views expressed by Stetson in his above-mentioned study be adopted:

> In actual speech . . . the smallest . . . unit [is] . . . the syllable . . . which is comparable to the note in music. . . . The phoneme represents a speech signal which has no independent existence but must occur in a syllable [which] is the unit for the word- and the sentence-stress. . . . Recordings show that demonstrators . . . who believe that they are producing isolated 'sounds' are actually producing syllables. . . . A syllable may have no significant aspect, no phoneme, or it may have as many as seven significant aspects of the syllable factors, phonemes. . . . The syllable is not a self-subsistent unit; it must be part of a foot and a breath group. The types of breath group and the position of the syllable in the breath group have a profound influence on the phoneme.

The theoretical data mentioned above presuppose some practical deductions. The wholistic, global approach to speech is once more confirmed, the elements composing the articulated language having no independent existence. We may consider the moving stream of speech as a succession of chemical compounds, each of them being built up of variable molecules—the syllables; the phonemes being the atoms, each of them having its specific characteristics. But if the atomic value of the smallest specific unit is broken down, the whole aspect

of the compound—the breath group—is changed consequently.

Clinical experience teaches us that for the adult aphasic who has not lost the learned process of speech, but only the power of evocation of the existing patterns, the syllabic factor is the smallest unit to start with in re-educating the lost mechanism. On the other hand, teaching speech to the deaf by combining merely the consonantal and vocalic elements, even if later in the process the rhythmic patterns of phrasing and stress are superimposed, leads imminently to disastrous results in its intelligibility.

Certain organs, by their interplay, induce the articulatory movements to mould them into the various patterns of speech which are recognized by the listener as a spoken language. It is within the oral cavity that articulation takes place. This includes the lips, the teeth, the tongue, the mandible, the cheeks, the hard palate, the velum, the faucial pillars, put into action by a complicated muscular mechanism attached to them.

Outline of the System

Our system of phonetical symbolization took into account that in a wide range of pathologic conditions the child or the adult patient has failed to develop normal speech through the natural auditory channel. This failure points to the necessity of seeking for the more accessible afferent sensory paths of visual, tactile or kinesthetic impressions. But beside a short memory span of auditory signals, these patients are generally hampered by a disturbed behavioural attitude, lack of attention toward the surrounding world, by psychic instability, leading to insufficient concentration on any kind of sensory impression.

We can thus assume that to be efficient, a system of symbolization has to be as simple as possible in its structure, requiring only a very short time to catch the attention of the patient. In addition, it should be simple in the train of movements that the patient will have to execute in an effort of imitation. But all these considerations should not be maintained at the expense of a sound physiology of speech. In conformation with the latter, our system is built neither on fixed positions alone, nor on articulatory movements. A precise articulation needs precise placement of the organs of speech. But as a continuous flow of movements, speech moves rapidly from one position to another, changing constantly the adjustment of the articulatory organs, and thus the phonemic value of uttered sound.

According to previously mentioned principles, all of the symbols in the system are divided into two categories—the dynamic and the static (See Figure 1). The static part involves the different organs participating in the formation of the adequate articulatory positions and building the source of visual and tactile perceptions. The dynamic part is built of the fingers and the hand, in constant movement to fix visually the position of a given symbol and to serve as a receptive organ of the tactile impression either of a vibration, in vowels and voiced consonants, or of a stream of escaping air, in the breath consonants, or in consonantal and vocal glides. Another important feature of our system is that any one of the symbolic clues is distinctly visible, whatever the articulatory position might be. Even in the production of the most hidden sounds, in the back of the oral cavity, or in the pharynx, the fingers or the hand mark clearly the identity of the sound.

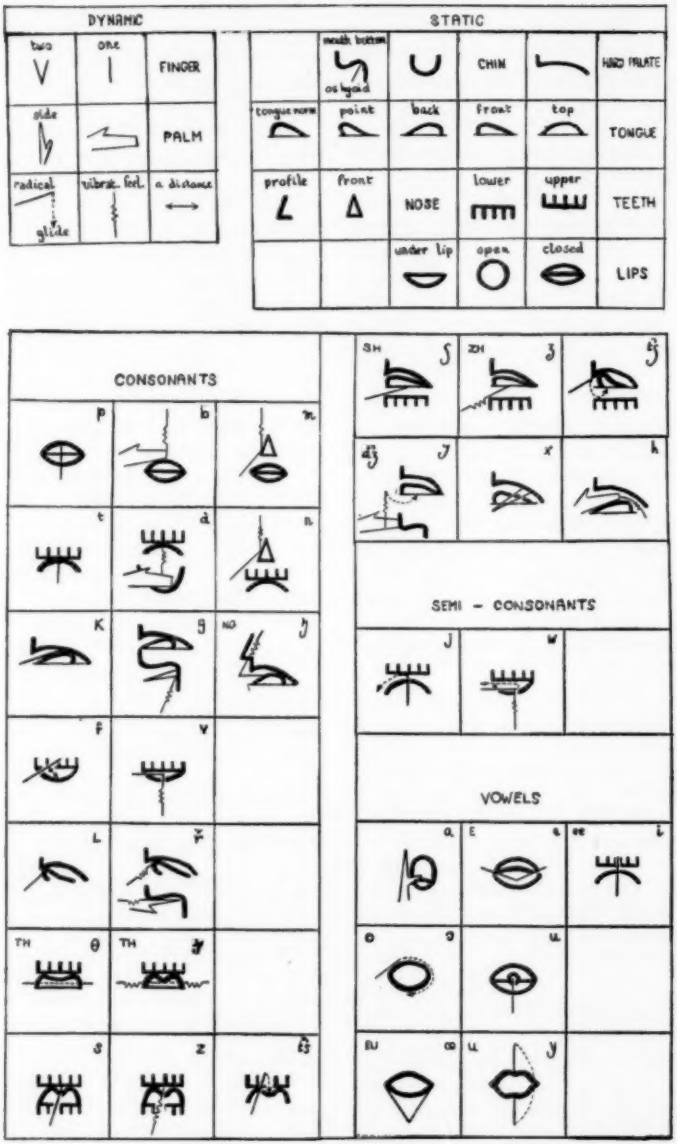

FIGURE 1. Graphic representation of method, showing the combination of positions and movements of the different phonemes.

Thus the dynamic part, by its form and tactile impression, completes the static part, and thus attains one of our main goals in building the system, namely, to make speech visible for everyone. Now, as to the simplicity of executing the different symbols, both for patients and therapists, our system relies on an important physiological finding: Not all of the positions assumed classically by phoneticians are essential for the production of a given sound. Many of them are only of secondary importance. As long as it has kept its phonemic value, and is recognized as the given sound, we can suppress all the superfluous adjustments, without impairing the acoustic end-result of the uttered sound. Some typical examples will underline our allegation.

Starting with the vowel system we may assume that the vowels can be brought down to five basic vowels, from which all others can easily be derived. These five vowels are: a, e, i, o, u. The first three are generally described as the front vowels, the latter as the back vowels. This differentiation has led many authors to adopt a schematic vowel diagram, which is based upon the assertion that fixed positions of the tongue are necessary for their production. The research of G. O. Russell, as mentioned by Kantner and West (7), has already discredited such vowel diagrams.

We can assert, moreover, that the tongue position is not the real criterion for the production of all the vowels. Here is a concrete example of this important fact: The two basic, so-called back vowels, the 'o' and 'u,' are classically described as assuming a steady elevation of the back of the tongue, reaching the highest position for the 'u' sound. But as anybody can prove for himself, by forcibly retaining the back of the tongue in a low, flat position, 'o' and 'u' sounds of a pure acoustic quality can still be produced if the lips are shaped in a rounding or protruding fashion. However, if we try to do the reverse, by forcibly preventing the lips and the mandible from moving, even though the typical back-tongue position is assumed, we would never be able to produce even minimally intelligible sounds of 'o' and 'u.'

The contrary is right for the so-called front vowels 'a,' 'e,' and 'i.' The tongue position is here essential, rising from the bottom of the mouth of the flat-lying 'a' sound, to an almost completely closing position of the 'i' sound separating the oral cavity into two chambers, an anterior and posterior one. The rising move of the mandible is of minor importance, while the progressive spreading of the lips, from the wide-opened vertical position of 'a' toward the slit horizontal position of spread lips in 'i' is definitely superfluous.

Another important fact emerges from this assumption. From the five basic vowels all others, in any language, can be derived easily, either by using changes of the tongue alone, or of the lips only. Take for example the French 'u' sound (phonetically 'y') as in the word 'pur.' The 'y' sound is easily produced by pinching the mouth corners, between the index and the thumb of one hand, when 'i' is uttered. The French sound of 'eu' as in 'peu' (I. P. A. 'œ') is produced by pinching and closing the lips in the vertical direction, from above and below, between thumb and index, when 'e' is initiated (See Figure 2).

With regard to the consonants, we agree with the classification of speech sounds from the placement approach as it is described in Kantner and West's kinesiologic phonetics (7).

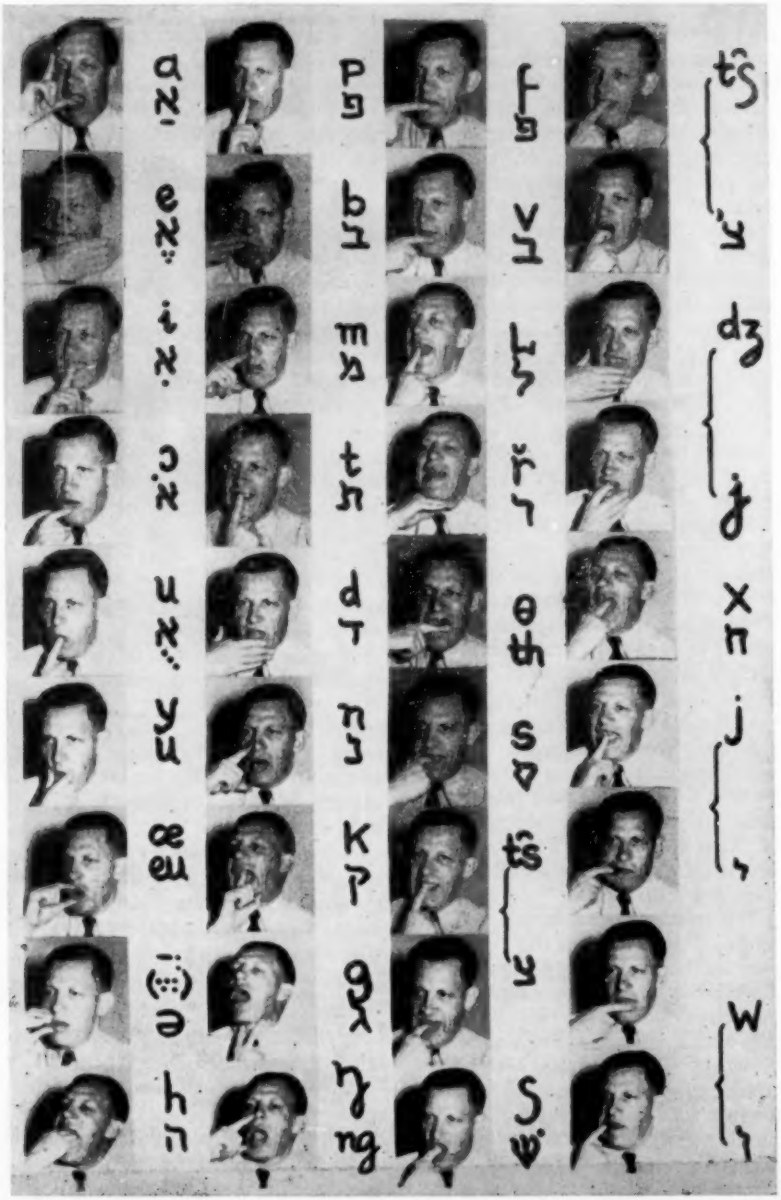

FIGURE 2. Photographed symbols of the Visual-Tactile Phonetical Method.

1. *The Beta consonants.* The lips are the articulatory, and the tongue plays only a passive role. (p, b, m, f, v, etc.)

2. *The Delta consonants.* The tip of the tongue against the teeth or the anterior hard palate are important, the lips having only a passive role. (t, d, n, s, z, sh, th, l, r, etc.)

3. *The Gamma consonants.* The main role is played by the back of the tongue against the roof of the mouth, or the velum. (k, g, x–German 'ach' sound)

This classification of the consonantal phonemes confirms once more the main principle of our phonetical system of symbolization, namely, that only some essential articulatory adjustments are vital to the production of the phonemes of any spoken language, and for practical, clinical needs we can use only a compendious way of phonetical symbolization. This fact allows one to simplify to the utmost the system of symbolization, without prejudicing the acoustic end-result of the articulation of any phoneme.

By recording only the final stage in the production of a sound, our system, a combination of optical and tactile impressions, allows us to represent by a specific symbol only this single sound, which cannot be confused with any other. If we have the same visual impression for the buccal plosives, p-b-m, of tightly closed lips followed by a sudden plosive opening, by placing the hand laterally on the maxillary bone, above the mouth, the vibratory impression here immediately identifies the 'b' sound, eliminating the 'p,' which cannot produce any perceptible vibration, and even the 'm,' for which the vibratory feeling on the maxilla is dampened and diffuse, but becomes intense and precise the moment a finger is placed laterally on the nose.

The change in the tactile impression of breathed and voiced consonants is easy to understand when their classification is attempted under the x-ray screen. Borel-Maisonny (*3*), in her study of the French consonants on the basis of radiologic findings, classifies them into two distinct families: (*1*) Those of the phonemes which want a firm muscular tension, whatever the character of its phonetic articulation. Those are the surd or breathed consonants. (*2*) All the voiced consonants, where a muscular relaxation is at its maximum in sounds like 'l' and 'y.' This fall in muscular tension can easily be perceived by moving the finger or hand from one articulatory position, which represents an unvoiced consonant, to another position of a voiced consonant.

The tactile impression is still markedly different between two surd consonants of the same class. Let us consider the two phonemes of 'p' and 'f.' In addition to the difference in the visual impression of the two symbols, the sudden explosive opening of the closed lips in 'p' will release an escaping stream of air which can be felt best in a limited area as the explosion concentrates the air in one central spot. The 'f' is different. The stream of air escaping between the upper teeth and the under lip is diffused, and must come in contact with a large surface of the same finger, which is consequently placed in the horizontal position. Once more, in this case as in any other, the physiologic necessity has brought us to two different symbols, from the visual and tactile point of view, merely by changing the position of the finger from the vertical to the horizontal position. The same consideration holds for the rest of our phonetical symbols.

As to the voiced consonants, we

have already mentioned above that for each voiced sound there always exists a spot of maximum vibration. We had therefore to choose the most favourable position of the fingers or the hand as a whole, to be brought in close contact with the vibrating parts of the facial bones or elsewhere.

Finally, we have to mention the kinetic way of producing vocal or consonantal glides. The finger has only to produce a gliding movement from one position to another, keeping in mind the exact timing of the tactile perception of the finger, relative to each of the two sounds involved in the

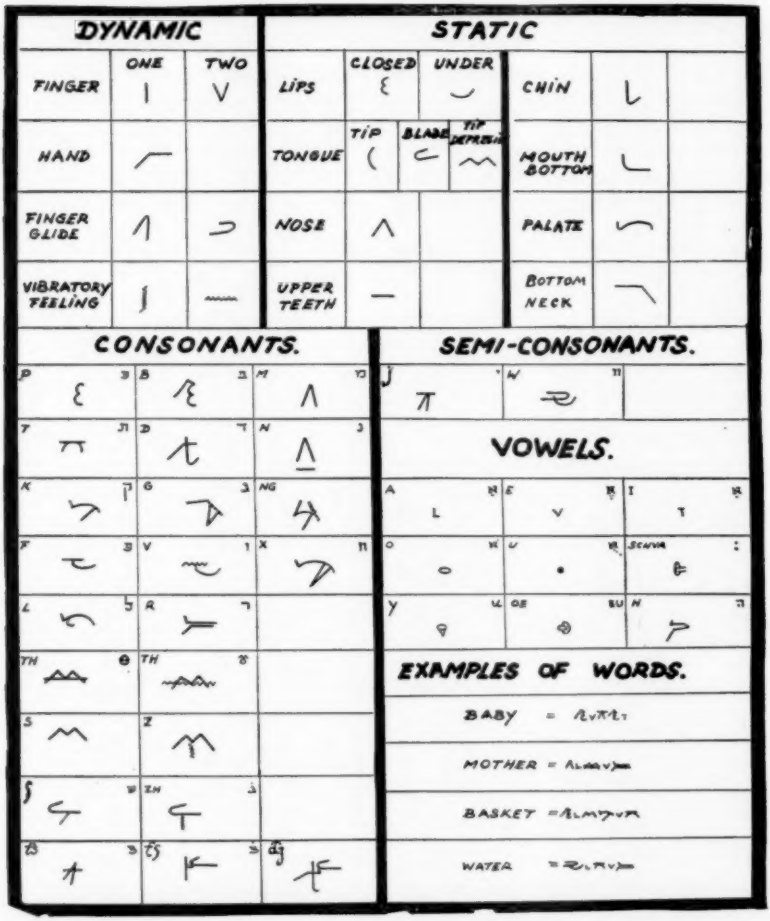

FIGURE 3. Phonetical transcription of the Visual-Tactile Method of phonetical symbolization.

gliding movement. For instance, take the production of the oral plosive approach to the 'sh.' In order to utter the English 'ch' sound, the glide movement starting with 't' remains only a very short while in contact with the upper teeth, but after having executed the glide movement toward 'sh,' remains there for quite a while (all proportions considered) (See Figures 2 and 3).

A complete description of all the symbols used in our phonetic system, and some examples of possible adaptation for English and French sounds, is contained in Table 1.

The system presented in this paper includes mainly phonemes of the colloquial Hebrew language. We make no claims, as did the Belgian chemist, F. M. Helmont, who, in Sulzbach, Germany in 1667, published an esoteric book in which he described Hebrew as the language natural to man. One of his main contentions was that the shape and character of each letter of the Hebrew alphabet conforms to the position and relations of the several speech organs involved in its production. It is, however, an undeniable fact that Hebrew was from its early origins a dynamic language, constantly changing in form and structure, and absorbing the linguistic values of the many peoples and races which surrounded the Israelites or were brought in contact with them by war or trade. Hebrew could well have influenced many European languages, by words, expressions and even some kind of phonetical markings being incorporated in them unawares. For instance, the mobile and fixed 'shva' markings, which have a particular significance in the pronounciation of different sounds of the Hebrew language, may well be the origin of the 'shva' vowels which are used extensively in the English language. The diacritic phonetic markings used in some dictionaries have been extensively used in the past, and even in our time in the Scriptures. The fact that in Hebrew the vowels are only marked above and under consonants indicates clearly that the smallest unit of speech, the syllable, was known by Hebrew phoneticians.

We have exploited to the utmost, in our phonetical system, the possibilities for simplification which colloquial Hebrew offers us in our day. The use we have made of the syllabic factor in developing speech in aphasic patients was facilitated by the use of the vowels as movements of arm, up and down, the finger marking the Hebrew dotting of the vowels. (See therapeutical application of the system, in next section.)

Therapeutic Applications

The main consideration that has guided us in evolving a new system of phonetical symbolization was, as already mentioned, the lack of an appropriate therapeutic instrument which could be recognized and used by speech correctionists in everyday clinical work. The great difficulty in speech training, under various pathologic conditions, such as deaf-muteness, delayed speech, or even aphasic conditions due to brain injury or damage, is the appropriate use of the phonetic elements in building meaningful speech entities, i.e., words and sentences.

Kurt Goldstein (*5*), speaking on retraining in speech defects, illustrates this fact in the following terms:

> It must never be forgotten that in all articulatory training we do not acquire the real sounds as we use them in language. Nor should we forget that the sounds we produce separately are not the same as those we use in words. In ordinary speech we do not speak by combining sounds into words.

TABLE 1. Complete description of all the phonetic symbols used in the Visual-Tactile System, and some examples of possible adaptation for English and French sounds.

Consonants		*Consonants*	
p	*Voiceless bilabial plosive.* Finger in front of closed lips, sudden opening permitting an explosive emission of air stream to impinge upon it.	v	*Voiced labio-dental continuant.* Finger applied transversally pressing the under lip to feel vibrating voice through mandible.
b	*Voiced bilabial plosive.* Hand placed laterally above closed lips to feel maxillary bone vibrate to voice resonating behind it. When sudden opening occurs, mandible drop felt.	θ	*Unvoiced lingua-alveolar continuant.* Finger taking support on the lower alveolar ridge in all its breadth, the protruded tongue resting on it, the emitted air passing above it.
m	*Nasal bilabial plosive.* Lips closed and finger placed laterally on the nose to feel vibrating voice.	ð	*Voiced lingua-alveolar continuant.* Same position with a feeling of vibration, and visual reproduction of trilling.
t	*Voiceless lingua-dental plosive.* Finger placed tightly over upper teeth, feeling the pressure of lingual tip, and suddenly dropped when explosion occurs and air stream escapes.	s	*Unvoiced lingua-dental fricative.* Finger tip inserted between the tightly closed upper and lower teeth, making a slight depression on extreme end of tongue to feel escaping air.
d	*Voiced lingua-dental plosive.* Hand placed across the chin, feeling voice vibration behind. Vibration stops when explosion occurs.	z	*Voiced lingua-dental fricative.* Same position as above. Vibrating voice impresses finger tip, which reproduces visually the trilling.
n	*Nasal lingua-dental plosive.* Finger applied laterally on the nose to feel vibrating voice. Vibration stops when plosion occurs.	ʃ	*Unvoiced lingua-palatal fricative.* Finger inserted under blade of tongue and stream of air emitted through closed mouth producing characteristic noises.
k	*Voiceless palato-lingual back plosive.* Finger obliquely inserted in widely open mouth to contact palate and back of tongue, feeling release of air stream on plosion.	ʒ	*Voiced lingua-palatal fricative.* Same position of finger and tongue. Vibrating voice impressing finger, which visually reproduces the trilling.
g	*Voiced palato-lingual plosive.* Two finger tips pressed on thyroid cartilage to feel vibration, and dropped when plosion occurs.	x	*Unvoiced lingua-velar fricative.* Two joined fingers inserted far back in the mouth to feel the uvula's trill under the pressure of escaping stream of air.
ŋ	*Nasal palato-lingual back plosive.* Index laterally placed on the nose to feel vibration, thumb maintaining palato-lingual position.		
f	*Unvoiced labio-dental continuant.* Finger placed transversally in front of under lip aperature to feel escaping air stream.		

Consonantal glides		*Vowels*	
ts	*Dental plosive approach to 's.'* Finger applied as for 't' rapidly gliding towards the 's' position and resting a while there to feel the air stream escaping.	e	*Mid-lingual vowel.* Thumb and index widely spread apart, maintaining mouth open, and the tongue flatly applied to the bottom of the mouth.
tʃ	*Dental plosive approach to 'sh.'* Finger, applied for 't' as previously, rapidly glides toward the 'sh' position, resting there a while to feel characteristic diffuse air escape.	i	*High-lingual vowel.* Finger vertically raised, the tip pointing to the centre of the upper alveolar ridge, and preventing the complete rise of the tongue's blade, in order to permit still-voiced sound to flow outside the mouth.
dʒ	*Dental plosive voiced approach to 'sh' sound.* Hand across the chin feeling production of 'd' for brief instant, then executing a rapid glide toward 'zh' sound and resting there for a while.	ɔ	*Rounded labial vowel.* Finger turning around a slightly open mouth shapes the vowel canal to emit the proper sound.
L	*Voiced lateral lingua-alveolar continuant.* Finger resting slightly on the point of tongue applied to the upper incisors. Voice vibration felt when sound emitted.	u	*Circular labial vowel.* Finger inserted through circular orifice of mouth slightly open, in position of finger sucking.
ř	*Voiced trilled lingua-alveolar continuant.* Hand applied under bottom of mouth feeling the voice vibration trilling intensely.	y	*Pinched rounded labial vowel horizontally. French 'i.'* While 'i' is produced, the corners of the mouth are pinched in horizontal direction.
ʁ	*Uvular rolled 'r' sound.* Hand applied across the thyroid cartilage giving intense trilling of voice.	œ	*Pinch-rounded labial vertically.* (French) After emitting 'e,' corners of mouth are pinched between thumb and index finger vertically.
j	*Semi consonantal-vocal glide.* Finger placed in 'i' position resting there for a while, and then slipping suddenly through corner of mouth.	ə	*Labial dumping vowel.* With the corners of the mouth firmly pinched, the issue of an uttered vowel is limited, and the sound produced is vague, as are the unstressed vowels.
w	*Semi consonantal-vocal glide.* Finger applied across the under lip producing 'v' sound for a while, then slipping suddenly through corner of mouth.		
ɑ	*Low-lingual vowel.* Index vertically used along corner of mouth, thumb applied horizontally at right angle on the tongue maintaining it flat and low on the bottom of the mouth, which is widely open.	h	*Glottal fricative approach.* Whisper position of the vocal folds, or sometimes the glottal vibratory approach, as in Hebrew; vowel's initiation through glottal vibratory approach. Hand inserted deep into the mouth to feel the vibrating indifferentiated sound flowing onto the joined fingers.

Later on Goldstein continues:

> It has been erroneously advocated that by learning of senseless combinations of syllables the patient might become capable of speaking new words consisting of these combinations. Although we start with articulatory training, we combine it as soon as possible, with instruction pointing out its significance for speech.

This is a crucial problem that every speech therapist has to deal with when starting a training procedure. How can we build up phonetic elements within a word or a phrase without breaking up its structural 'Gestalt' as it appears in the flow of a meaningful spoken language? We had this in mind when devising our system of articulatory symbols. Here appears all the significance of dividing the system in an active dynamic part, and a static positional part. By being able to move constantly the active symbols, finger or hand, from one articulatory position to another we are keeping the normal train of syllables representing speech sounds uttered in succession with all their characteristics of accent and stress, as it appears in correct and normal speech. One is not obliged, therefore, to isolate the speech elements from the context in a word or phrase. The speech correctionist can demonstrate the adequate sound symbols within a word merely by slowing down the rate of speech utterance and resting on the sound that he wants to correct.

Another important aspect of our system is that to produce a distinct tactile impression in different phonemic symbols requires an accurate voice placement. Thus, in production of vowels and voiced consonants, if correctly done, there is no other possibility than to bring the voice automatically toward the facial bones and other parts of the articulatory organs, to produce a maximal feeling of vibration in each case. For instance, the intense perception of vibration in a finger placed on the under lip when the 'v' sound is uttered; or the vibratory impression which is produced on the two fingers applied against the hyoid bone in the 'g'; or the feeling of the hand placed across the chin in 'd'; or for the 'r' the intense vibration felt on the hand placed under the mandible, etc. If for some reason the voice would not be produced in the right way, and the placement in the resonating cavities be disturbed, the vibration could not be felt on the right place required by the given phonetical symbol.

The same could be said about the tactile impression required by non-voiced consonants. In producing the 's' sound, the air escaping through the depressed tip of the tongue must make an intense and concentrated impression on the finger, whereas it is diffuse, softer and warmer when the same finger is placed under the tongue for the 'sh' sound. This feature of the system is important both for a proper articulatory adjustment and a maximal voice or air emission for any correct sound uttered in speech.

When considering the usefulness of a therapeutic measure, one should evaluate the facility of its application. The most integral and precise phonetic system would not be adopted by the practioner if it were not simple in application to the patient, and easy to manipulate by himself. The fate of the 'Visible Speech' system was an object lesson to us, stressing the need of aiming toward the utmost simplicity in the structure and execution of our method of symbolic systematization. This was also the reason why we waited many years before making our system known. We were fortunate indeed in having to put it on trial in many cases of emergency. The con-

stant arrival of huge contingents of immigrants, chiefly from primitive surroundings, obliged us to deal with large numbers of speech defectives of all kinds. A complication of this immigration was the bi-lingual and even tri-lingual families, where the speech defective child was submitted to conflicting language experiences.

We had thus to deal with the patients on one hand, and at the same time to train, on short notice, speech correctionists or teachers of the deaf. Instead of a normal curriculum of several years we had to start with ordinary teachers, and train them in the course of a regular school year in our Institute for the Deaf. We were amazed how rapidly, in a matter of a few weeks, both teachers and children became familiar with our system of phonetical symbolization. The children were particularly remarkable in actually starting to utter meaningful speech in an intelligible way, both orally and by retaining the graphic representation of the symbols.

Finally, we wish to stress the astonishing range of speech disorders in which the system can be used to the best advantage. Surveying a great number of treatises and manuals in speech correction, one is embarrassed by the number of painstaking procedures proposed by different authors for dealing with each disorder. Although thoroughly aware of the danger of promoting a panacea cure for every defect and every type of patient, we have found, nevertheless, that some basic instrument has to be used in speech correction, which can be advantageously complemented by supplementary techniques and procedures.

We were convinced, moreover, that such an instrument which is concerned with speech must rely primarily on one or another sort of phonetical system. After several years of practice we can affirm without hesitation that our system of symbolization is an omnibus system, which can be applied as a basic instrument of work with almost any speech disorder. It is not possible within the scope of this paper to describe in detail the exact technique followed in any individual disorder, and still more to report on individual cases. This is to be the purpose of other publications which we hope to produce shortly. We shall sketch only briefly the methodology we have used in main speech defects.

Kantner and West (7) speak of the rehabilitation of the deaf in these terms:

> An important application of phonetics is in the teaching of speech to those who are deaf . . . [and] cannot follow acoustic models in learning it . . . [but] must . . . produce . . . speech sounds by learning to imitate the positions and movements of the speech organs . . . In order that he may produce the proper acoustic effect, his teacher must be able to show him . . . all the necessary adjustments of the speech organs . . . Any means that will make the pupil-patient's vocal tone palpable or visible . . . may be employed. He must be able, not only to produce an effective vocal tone, but also to start it and stop it precisely, so as to meet the requirements of continuous speech, in which voiced and unvoiced sounds follow each other in rapid succession.

We have already mentioned previously how all these conditions can be integrally fulfilled by using our system. We wish to add that by starting with a global speech which the little deaf child has to lipread as meaningful language concepts, we do not postpone the imitative response to a later stage. Immediately following the lipreading of a 'word-concept,' which has to be uttered by the teacher in a natural way, we provoke the speech response in the child by teaching him the initial syllable of the word through seeing and touching the areas on the

teacher's face which produce the adequate phonetical symbol. We always complete the word-concept by a gesture representative of the object or action, making the uttered word meaningful to the child.

This is done because speech to be natural must be conditioned, as in normal children. Stetson (*9*) has stated:

> The fixation of the particular trait of the phoneme, and the way it functions . . . in the syllable, depend on the process [of] . . . conditioning. . . . In speech we speak in sequences of syllabic pulses, but these sequences to be memorised must have *conditioned meanings.*

In a di-syllabic word we teach only the initial phonetic symbol of the initial syllable, the second syllable being uttered by the teacher simultaneously with a significant gesture illustrating the word. Only later do we produce the symbol of the second syllable, if the visual pattern lipread by the child was not sufficient to make the entire word intelligible enough.

Naturally, in rehabilitating the speech of the deaf we use auditory training and other technical devices to develop the remnants of hearing still present. But the basic instrument remains always the system of phonetical symbolization. The finger or hand moving from one articulatory position to another, without breaking up the continuous flow of syllables, makes possible the production of whole words in their natural relation in the breath group. By keeping the finger more or less in contact with the articulatory organs preserves an adequate length to the syllable within the word, i.e., the proper accent, and thus building the pattern of normal stress in the breath group itself. And last, but not least, the same finger, feeling the flow of air or voice, gives a proper voice placement and stabilization of the adequate natural pitch in voice production. Our phonetical system has enabled us to accept at our Institute for the Deaf youngsters between 12 and 16 years of age without any preparation in oral language, and to make them use meaningful speech of several hundred words at the end of the first school year. We have even successfully attempted to rehabilitate adult deaf by the same method, with individual training. We would not have ventured to attempt this before having devised our phonetical method.

In delayed speech, congenital aphasia of the mixed type (sensori motor), or in pure motor aphasia, the patient is unable to recall through hearing alone the ordered and exact succession of the different phonemes which constitute a syllable, or a combination of syllables as they appear in a word. In teaching speech to the aphasic, both the congenital and the adult after brain damage, a major factor is to induce the initial motor impulse, 'a starter,' in building the first syllable in words of one or two syllables, and the two first syllables in three syllabic words, etc. When the initial phoneme is fixed in the memory through our phonetic symbol or symbols, the last one is easily retained merely by a symbolic gesture representing the meaning of the word.

An example will illustrate the procedure we always use: In the word 'bottle,' we teach first the 'b' sound by the phonetical symbol, and thus produce the first syllable 'bott,' and the second syllable 'le' by imitating the gesture of drinking from a bottle. In the French word 'chapeau,' we first produce the symbol of 'sh,' and complete it by a gesture which represents covering the head with a hat (See Figure 4).

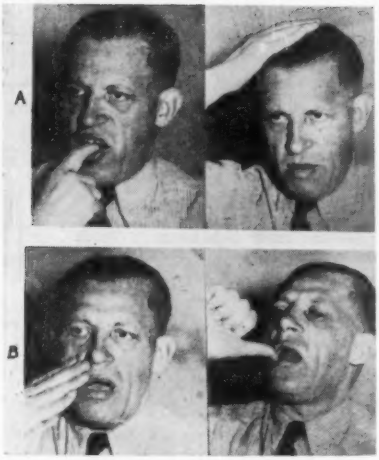

FIGURE 4. A. Formation of the French word 'chapeau' by marking the first syllable by the phonetic symbol of 'sh' and completing it by a gesture of covering the head with a hat. B. Formation of the word 'bottle' through the Visual-Tactile system of phonetical symbolization. In the first syllable the 'b' sound is produced by the phonetical symbol, and the word completed by gesture of drinking.

The completion of the releasing consonant of the first syllable ('b' in the first word, and 'sh' in the second) by a vowel, may be recorded by the acoustic impression only, as it was in the deaf by the visual one. But in severe aphasic conditions, or in delayed speech with a short auditory memory span, we have to build the first syllable completely. We use then the vocalic notation of Hebrew, represented by vocalic dottings above and below the consonant.

For instance, in the word 'ma-ca-ro-ni,' a four-syllabic word, we proceed as follows: 'm' phonetical symbol prolonged by a horizontal movement of the vowel 'a' (Hebrew patach); 'k' and the same movement as for 'a'; 'r' and a finger placed vertically in an upward direction ('o' kholam, the Hebrew 'o'); and the final syllable by making the gesture of putting a long piece of macaroni in one's mouth (See Figure 5).

With small children we often use the kinetic approach. They produce the consonantal phoneme through our phonetic symbol, step on a floor tile (with which every floor in Israel is covered), and complete the vowel through a conventional movement ('a,' both hands lifted vertically; 'e,' balancing movement; 'i,' index pointed straight forward; 'o,' rounded arms joined together above the head; 'u,' circular movement of both arms).

To summarize our procedure, in treating aphasic patients to make use of meaningful and intelligible speech we have to insist on: Use of our phonetical symbol as a 'starter' to release the evocational mechanism of speech, disturbed in these patients; building or rebuilding the motor associations in a reversed direction, in an afferent way,

FIGURE 5. Demonstration to an aphasic patient the way of producing the word 'macaroni.'

from the peripheral motor end-result performance, toward the central area of Broca initiating the patterned impulses of speech units.

In correcting dyslalic speech, our phonetic system yields a very simple method of handling the defective sound. Here is an example of our procedure in correcting a Sigmatismus (interdentalis, lateralis, addentalis, or whatsoever). We ask the patient to drop his lower jaw as in yawning, the tongue assuming a neutral position, the tip lying quietly behind the lower teeth. We then ask the patient to put his finger lightly on the extreme tip of the tongue and close his mouth again to let a flow of air escape. The correct 's' sound is immediately produced.

In the same way, by using the phonetic symbols of our system, we can easily correct every defective sound. Some time ago we had to treat a young boy of 12 for a defective 'l' sound which caused him to be ridiculed at school. An unsuccessful attempt was made to correct this defect a couple of years previously. With our phonetic symbol, immediately mobilized by the moving finger from one 'l' to another, and then in combination with various vowels and consonants, the correction was successful in two to three sittings.

Even in cleft palate speech we experienced rapid progress by directing the stream of air first in the 'p' sound and rapidly combining it with the vowels, then through the other unvoiced plosives ('t' and 'k'), the 'f' and other unvoiced continuants, we could build up all the syllables, and each time complete them by producing the acquired elements in words. We then proceed to read with the symbols, and finally to sustain a conversation with the phonetic system constantly used. By such a procedure the rehabilitation of a cleft palate case, without serious organic damage to the palatal structures or teeth system, can be amazingly shortened to a period of a few months at the utmost. Naturally, in all the dyslalic and other disorders previously considered, adventitious remedial procedures can be used simultaneously with our system.

We wish finally to mention the problem of teaching foreign languages or of correcting foreign accents. These cannot be successfully achieved in most adult individuals, for the auditory channel alone is notoriously insufficient to break down the conditioned native speech with its repetition of accents in the combined syllables, the way of phrasing, stressing, correct formation of the new phonetical elements of a foreign language, and many other problems to be considered in acquiring a new language. All of these crucial problems might be facilitated by the use of our phonetical system. Our experience in the linguistic field being very limited, we anticipate that someone more qualified will be able to extend the research in this direction.

To conclude the therapeutic application of our system of phonetic symbolization, we wish to mention, with reserve (the new device being on an experimental level yet), the possibility of using our symbols as 'starters,' producing initial speech impulses, to overcome the initial blocks in stutterers. Considering the rehabilitation of a stutterer as a process of central reconditioning of speech, pointing to the relation of this disablement to aphasia, the use of a peripheral 'starter' might have a clinical logic, which further experience collected in this field would confirm or disprove.

We do not consider our phonetical system as definitely codified, and our research in this field as completed. We feel rather that we have just penetrated the surface of extremely fertile soil. If our tentative attempts lead to the establishment of a universal method of phonetical symbolization as the main weapon in rehabilitating defective speech in every language, and for all people, this modest endeavour of ours will not be in vain.

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Relations Of Stuttering In Spontaneous Speech To Speech Content And To Adaptation

Wilbur E. Moore

THE PROBLEM of measuring stuttering severity, whether in oral reading or in spontaneous speech, involves certain assumptions or requirements which are difficult to meet and which in some studies have not been met. Because of the apparent relation between the syllables or words and stuttering spasms much of the research on stuttering severity has of necessity utilized oral reading, evidently in order to keep 'constant' the quantity and content of speech. This procedure involves the assumption that the 'same word' in print has the 'same significance' and evokes the 'same semantic reaction' in all stutterers. It also involves the assumption that differences in reading skill will not systematically affect the stuttering severity in subsequent readings of the 'same material.' Such assumptions have apparently been necessary in order to make any headway in the study of psychological and phonetic factors related to stuttering.

Similarly, any attempt to measure stuttering severity in spontaneous speech involves a number of assumptions which are hard to satisfy. First, the assumption that the *number* of words or syllables will have a linear relation to stuttering spasms must underlie the use of percentages, ratios, or analysis of covariance. Second, the requirement of homogeneity of variance may be and apparently is often overlooked in the use of *t*-ratios and analyses of variance.

In an effort to study stuttering in a setting as similar as possible to that in which 'daily' stuttering occurs, Moore, Soderberg and Powell (*3*), employed an analysis of covariance of the number of words spoken to the duration of stuttering spasms. The words were evoked by questions about certain areas which were considered to be important to the stutterers.

In this earlier research the assumptions of homogeneity of variance and linearity of regression were tested and justified, although not reported.

Following the line of investigation suggested by the data in that study, the present experiment was designed to duplicate the analysis of two topics or areas which seemed to have widely different relations to stuttering and to investigate the possibility of relationships between additional topics and stuttering severity. At the same time, it was possible to deter-

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mine whether the adaptation effect which has been observed in stuttering during oral reading also occurred in stuttering during spontaneous speech.

Procedure

Spontaneous speech responses, the quantity of which was neither knowingly stimulated nor inhibited by any means except the volition to respond to questions, were secured from 17 stutterers who were in the sixth week of the 1952 intensive clinic at Central Michigan College. The three female and 14 male stutterers ranged in age from 11 years, 6 months to 26 years, 3 months. All fell within the normal and superior levels of intelligence on the Wechsler-Bellevue Performance Scale, the highest score being 128 and the lowest 89. Responses were secured from three additional teen-age subjects in the clinic but no stuttering in spontaneous speech occurred, although measurable degrees were observed in their oral reading.

Each subject, seated in the college radio studio, was presented with typed requests to tell three incidents about each of the following: his family, his school, his speech, his recreation, his stay at the intensive clinic, and his work. Upon completion of the third incident in each area, the subject turned a card on which was the typed request to retell the three incidents as similarly to the first telling as possible. Each subject spoke into a microphone which was connected to a Gates amplifier and mixer, an Ampex tape recorder and a monitor. All instruments as well as the studio met NARTB specifications.

The experimenter, seated in the control room, recorded each stuttering spasm by means of an electrically activated stylus upon a polygraph tape moving at a constant speed of 16 mm per second.

Each group of six subjects was selected at random to talk on the six topics presented in the following order:

Subjects	*Topics*					
	1	2	3	4	5	6
	6	5	4	3	2	1
	2	4	6	1	3	5
	3	6	2	5	1	4
	4	1	5	2	6	3
	5	3	1	6	4	2

By means of the polygraph tape the duration of stuttering was measured to the nearest .0625 second and recorded in that unit. The reliability of the measurements of the stuttering duration was found by calculating product moment coefficients of correlation between six complete sets of measurements selected at random and a second set made from tape recordings. These correlations were .91, .90, .94, .96, .93 and .92, the over-all coefficient being .93.

The reliability of the stenographic transcriptions of the tape recordings and word count was estimated by replaying the tapes and marking each word omitted. There was 99.8 per cent agreement between the experimenter and the stenographer who made the transcription.

In the analysis of covariance, the basic statistics were the mean number of words spoken on the two tellings of the three incidents and the mean duration of stuttering occurring during the speech. (Total words on each topic divided by six. Total duration divided by six.) The smallest sample of words on one topic from a single subject was 120. This number occurred three times. The next smallest was 168. This number also occurred three times. The largest sample on one topic from a single subject was 1644 words.

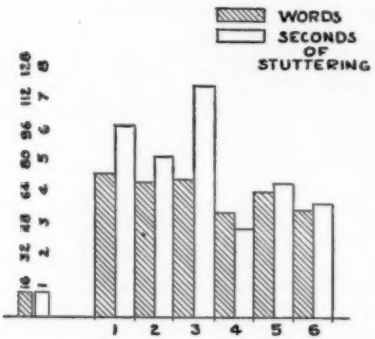

FIGURE 1. Mean number of words spoken on each incident (cross-hatched) and mean durations of stuttering in seconds on each incident (open). 1, family; 2, school; 3, speech; 4, recreation; 5, clinic; 6, work.

Two analyses of covariance were made. The first analysis was according to the topic. The second analysis was according to the order of response, regardless of topic. In addition to revealing information about the adaptation effect in stuttering during spontaneous speech, the second analysis served as an invaluable check upon the computations made in the topical analysis.

Results

From the 17 subjects a sample of 36,628 words were obtained. The total duration of stuttering was 2960.25 seconds. Figure 1 shows the mean number of words spoken and the mean durations of stuttering on each incident. The analysis of covariance of words spoken and duration of stuttering by topics is summarized in Table 1. The F of 4.24, which is significant to the .01 level of confidence, indicates that after the adjustment has been made for the differences in the number of words spoken on the different topics, the differences among the means of stuttering duration are significant. In other words the differences in the amount of stuttering are not the result of the differences in the amount of talk. This conclusion can be held only with reservation, however, since there is evidence that the basic assumption of homogeneity of variances of speech samples has not been satisfied. Table 2, which summarizes the analysis of individual regressions and correlation coefficients, also reveals in the final column the probable heterogeneity of the mean squares, i.e., of

TABLE 1. Analysis of covariance of words spoken and stuttering duration (by topics).

Source of Variation	*df*	*Words* Sx^2	Sxy	*Stuttering* Sy^2	*Errors of Estimate* *Sums of Squares*	*df*	*Mean Square*
Between topics	5	6022	17183	62570			
Between rows	16	79174	−25469	275031			
Residual within topics (error)	80	70033	42979	180621	154245	79	1952
Total	101	155229	34693	518222			
Between topics plus error	85	76055	60162	243191	195601	84	
Adjusted means*					41356	5	8271

F=4.24 (significant .01 level of confidence)

*Adjusted means=195601−154245

TABLE 2. Individual regression and correlation coefficients (by topics).

Source of Variation	df	Words Ss^2	Sxy	Stuttering Sy^2	Correlation	Regression Coefficients	Errors of Estimate: Sums of Squares	df	Mean Square
Family	16	66302	−1192	51954	−.020	−.0179	51932	15	3462
School	16	23224	−8692	47592	−.262	−.3742	44938	15	2996
Speech	16	12656	20078	256036	.353	1.5864	224184	15	14946
Recreation	16	20928	4460	13264	.268	.2131	12314	15	821
Clinic	16	15872	6376	75104	.185	.4017	64942	15	4329
Work	16	10224	−3520	11704	−.587	−.3442	10492	15	699
Total	96	149207	17510	455654	.021	.1173	408802	90	4542

TABLE 3. Test of homogeneity of variance of number of words spoken on each topic.

Sample	Variance	log
Family	4144	3.61742
School	1452	3.16197
Speech	791	2.89818
Recreation	1308	3.11661
Clinic	992	2.99651
Work	639	2.79996
	9326	18.59065
	Mean variance=1554	log=3.19145

$$\chi^2 = \frac{20.5594}{1.0243} = 20.0716 \text{ (significant .01 level of confidence)}$$

TABLE 4. Test of linearity of regression (by topics).

Source of Variation	Sums of Squares	df	Variance
Between topics	62570	5	
Within topics	455652	96	4746
Total	518222	101	
Between topics	62570	5	
Due to linear regression $\frac{(\Sigma xy)^2}{\Sigma x^2}$	7753	1	
Due to departure from linearity	54817	4	13704

$F=2.887$ (significant .05 level of confidence)

TABLE 5. Analysis of stuttering duration variance on the first 120 words spoken on each topic.

Source of Variation	*Sums of Squares*	*df*	*Estimate of Variance*
Total	102067	101	
Between topics	5465	5	1093
Between rows	80622	16	5039
Residual	15980	80	200

$$F=\frac{1093}{200}=5.46 \text{ (significant .001 level of confidence)}$$

the adjusted variances. The application of Cochran's test of homogeneity of variance indicates a value of .548 which is significant to the .01 level of confidence. To determine whether this significant heterogeneity was the result of the extreme variability of stuttering or the result of the lack of homogeneity in the word samples, Bartlett's test of homogeneity was applied to the variances of the number of words spoken on each topic. That test is summarized in Table 3.

The χ^2 of 20.0716, which is significant to the .01 level of confidence, indicates that the assumption of homogeneity of variance among word samples is violated. This departure from homogeneity could be a sampling phenomenon or it could mean that the topic of speech is related to the variability in the quantity of speech. Since the direction and the extent of error because of this failure of groups to manifest like variances has not been determined (2), the inference that the differences among the means of stuttering duration are significant can be accepted with reservation.

Similarly the test of linearity of regression of stuttering upon word output raises some doubts about a basic requirement of covariance but does not justify the complete rejection of the hypothesis of linearity. This test, which is summarized in Table 4, is significant only to the .05 level of confidence.

In view of the doubts raised, and in view of the reports of intra-passage adaptation (*4*), an analysis of the variance of stuttering duration on the first 120 words spoken on each topic was made. That analysis is summarized in Table 5. The *F* of 5.46, significant to the .001 level of confidence, clearly indicates that at the beginning of speech responses to topical questions, stuttering severity is related to the question asked. Figure 2 presents graphically the differences in mean durations of stuttering on the first 120 words of each topic.

The analysis of the relation of stuttering duration to words spoken in

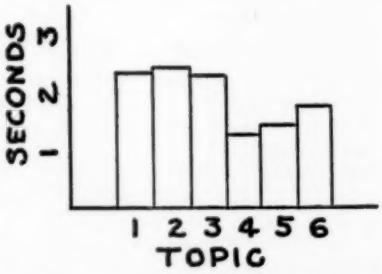

FIGURE 2. Mean durations of stuttering in seconds on the first 120 words of each topic. 1, family; 2, school; 3, speech; 4, recreation; 5, clinic; 6, work.

TABLE 6. Test of linearity of regression (by order).

Source of Variation	*Sums of Squares*	*df*	*Variance*
Between orders	19446	5	
Within orders	498776	96	5196
Total	518222	101	
Between orders	19446	5	
Due to linear regression $\frac{(\Sigma xy)^2}{\Sigma x^2}$	7754	1	
Due to departure from linearity	11692	4	2923
F=.5625			

TABLE 7. Test of homogeneity of variance of number of words spoken in each order.

Sample	*Variance*	*log*
1st	1277	3.10619
2nd	3167	3.50065
3rd	1450	3.16137
4th	1192	3.07628
5th	507	2.70501
6th	1405	3.14768
	8998	18.69778
	Mean variance = 1500	log = 3.17609

$$\chi^2=\frac{13.21729}{1.0243}=12.9037 \text{ (significant .05 level of confidence)}$$

TABLE 8. Analysis of covariance of words spoken and stuttering duration (by order).

Source of Variation	*df*	*Words* Sx^2	Sxy	*Stuttering* Sy^2	*Errors of Estimate* *Sums of Squares*	*df*	*Mean Square*
Between orders	5	2254	4662	19446			
Between rows	16	79174	−25469	275031			
Residual within orders (error)	80	73801	55500	223745	182008	79	2304
Total	101	155229	34693	518222			
Between orders plus error	85	76055	60162	243191	195601	84	
Adjusted means*					13593	5	2719
F=1.18 (non-significant)							

*Adjusted means=195601–182008

TABLE 9. Individual regression and correlation coefficients (by order).

Source of Variation	df	Words Sx^2	Sxy	Stuttering Sy^2	Correlation	Regression Coefficients	Errors of Estimate Sums of Squares	df	Mean Square
First	16	21712	26060	215088	.381	1.2002	202474	15	13498
Second	16	53841	11089	48240	.218	.2059	45956	15	3064
Third	16	24656	−312	19920	−.014	−.0126	19916	15	1328
Fourth	16	20260	954	60794	.027	.0470	60750	15	4050
Fifth	16	8616	−3660	101758	−.123	−.4247	100204	15	6680
Sixth	16	23888	−4104	52976	−.155	−.1718	52272	15	3485
Total	96	152975	30027	498776	.109	.1962	481572	90	5350

respect to the time order of response instead of the topic of discourse reveals striking differences. First of all, the linearity of the relation is not open to doubt, and the sampling of words falls close to the required degree of homogeneity. Table 6 summarizes the test of linearity and Table 7 the test of homogeneity of variance of word output.

By comparing Table 8, which gives the analysis of covariance by time order of response, with Table 1, which gives the analysis of covariance by topics, one has a check upon the accuracy of calculation of both analyses. Table 8 also shows that unlike the topic of speech itself, the temporal order or place of a talk has no bearing upon stuttering duration. Table 9 summarizes the individual regression and correlation data. Since in the analysis of covariance of total words spoken and total stuttering duration, no significant difference between the orders of response was indicated, an analysis of variance of stuttering on the first 120 words spoken in each order of response was computed.

Table 10 reveals that no significant differences obtain among the means of stuttering on the first 120 words in the different orders of response. Figure 3, however, which is based on the mean duration of stuttering for each order of response does reveal the characteristic 'adaptation' and 'negative adaptation' that have been observed in the oral reading of different material (5).

TABLE 10. Analysis of stuttering duration variance on the first 120 words spoken in each order.

Source of Variation	Sums of Squares	df	Estimate of Variance
Total	102067	101	
Between orders	1094	5	219
Between rows	80622	16	5039
Residual	20351	80	254

$$F = \frac{219}{254} = .862$$

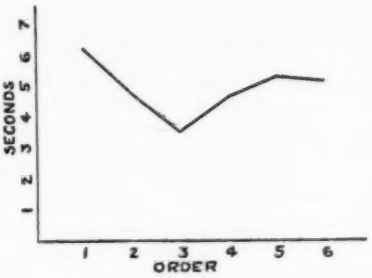

FIGURE 3. Mean durations of stuttering in seconds on each of the six orders of response.

Conclusions

Although extended generalizations about stuttering in spontaneous speech are not yet warranted, particularly since the samples are small, certain definite conclusions may be drawn about the stuttering of the 17 subjects in the present study and the 16 subjects in the study by Moore, Soderberg, and Powell (*3*).

First, it is highly probable that topics like parents, family, and speech are ideational systems closely associated with increased duration of stuttering. At the same time they are ideational systems on which there is such a need to talk that increased stuttering per word does not inhibit the verbal output. In fact, it is on these topics on which the stuttering per word is greatest that the greatest number of words are spoken. If there is an anxiety that is related to stuttering, there is also apparently a compulsion to talk. The dysrhythmic muscular contractions observed in stuttering may be a fragmentation of behavior resulting from or at least related to the motivational conflict over talking and anxiety about the talking or the audience, or the situation, or the *topic*. Perhaps, the main difference between the anxiously shy individual and the stutterer is that it is easier for the shy person 'to keep his mouth shut.'

An examination of the significantly larger adjusted variances on the topic, Speech, and on the first response suggest strongly that as pressure and stuttering increase, the variability of the response increases. In a word, under 'pressure' stuttering not only increases, but it also becomes more variable.

In view of the possibility that a non-linear relationship between the number of words spoken on some topics and stuttering severity may exist, more precise experiments for measuring and determining the nature of the non-linearity are urgently needed. In studies of the adaptation effect, however, the assumption of linearity of regression seems justified since, in the analysis of covariance by order, the regression of stuttering duration upon the number of words spoken was linear. This fact seems particularly significant since prior studies of stuttering have assumed a linear relationship without analyzing it and have sought to strengthen generalizations by increasing the size of word samples.

The results have certain implications for managing stutterers. First, certain topics are better than others for establishing easy speech situations. These topics generally are good times, work and hopes. Other areas, such as family, parents, and speech, probably need more reorganization and re-evaluation by the stutterers.

Finally, if short word samples on different topics prove to be adequate for measuring the relation between stuttering severity and attitudes, the measurement of changes in stutterers during clinical treatment will be greatly facilitated.

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Rorschach Prognosis In Psychotherapy and Speech Therapy

Joseph G. Sheehan

SINCE THE Rorschach, along with other projective tests, is gaining ever-increasing acceptance and utilization in a variety of clinical situations, its possibilities for effective patient selection in speech clinics deserve systematic exploration.

The present article reports the outcome of Rorschach prognosis on a group of stutterers treated from the point of view that stuttering is an approach-avoidance conflict expressed simultaneously at various levels (*6*). This treatment involves an integrated speech therapy and psychotherapy aimed at reducing the stutterer's conflict through attacking word and situation fears, encouraging expression of feeling, improving interpersonal relationships, and developing more adaptive goals. The speech therapy portion of the treatment is essentially that of the 'Iowa school' of non-avoidance as represented by Van Riper (*8*), Johnson (*2*), and Bryngelson (*1*).

The psychotherapy portion of the treatment included individual sessions and group discussions, and though approached from a modified psychoanalytic view, it should probably be characterized as eclectic. The implications for psychotherapy of stuttering as an approach-avoidance conflict, and the handling of speech therapy as a specialized technique in psychotherapy within this framework, are discussed more thoroughly in a separate paper (*6*).

The data included in this paper are drawn from a validity study of the Rorschach Prognostic Rating Scale by Sheehan, Frederick, Rosevear and Spiegelman (7), and the tables published in the latter contain more detailed statistical presentation of the findings reported here.

The Rorschach records of 35 stutterers at the U.C.L.A. Psychological and Speech Clinic were scored by the Klopfer system and then rated by a prognostic scale developed by Klopfer and his co-workers (*3*, *4*). The scale is essentially a refinement and further specification of the Rorschach scoring system developed by Klopfer.

After the record has been scored in the usual way by the Klopfer system, and form level rating completed, each response is rated for the prognostic scale. The ratings are based upon the manner in which the patient uses movement, shading, and color, as well as the accuracy and definiteness with which he sees his concepts. For example, active movement, freely seen, and involving real people of the immediate cultural milieu, is rated more

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highly than passive movement, reluctantly given, of culturally distant figures. Weightings of 1 are given to responses of favorable prognostic quality, while ½ or 0 are given less favorable responses and very poor quality responses are given minus ratings. The algebraic sum of the resulting raw weights is converted into a weighted score by means of special tables published with the scale. This procedure is followed for five determinant categories: human movement, animal movement, inanimate movement, shading, and color.

The weighted score from these categories, together with the average form level rating, is totalled into a *final prognostic score*. Six prognostic groups were set up, ranging in numerical score value from minus 12 to plus 17, and in meaning from the hopeless case to the most promising.

Psychotic patients or those with severe character disorders are expected to have ratings in the lower groups, while neurotic patients are more likely to be found in the upper groups (*3*).

The stutterers included in this study fell in Klopfer Groups II, III, and IV, making them relatively good treatment prospects. In view of the widely circulated clinical impression that stutterers are difficult or discouraging to treat, this in itself is an interesting finding.

Predictions from the Rorschach Prognostic Scale were compared with therapeutic outcome as reflected in two indices: (a) those who continued therapy as against those who dropped; and (b) those who improved most as against those who improved least, as measured by therapist ratings.

Two different dimensions of improvement were rated by the therapists: speech behavior or symptom improvement, and personality or psychotherapeutic improvement. Ratings in each were made according to a four-step scale: (*1*) great improvement, (2) substantial improvement, (3) slight improvement, and (4) none or worse. In this manner those who improved slightly or not at all were separated from those who showed substantial or great improvement.

Three therapists rated each of the patients, so that three sets of such ratings were obtained. The modal rating was taken as representative of the combined judgment of the three raters. Those patients rated 1 and 2 were combined into one group, Improved Most, and those rated 3 and 4 were placed in another group, Improved Least. Of the 35 patients, 19 were rated in the Improved Most group and 16 in the Improved Least group. Thirty of the patients continued in therapy while five dropped, all of the latter in the Improved Least group.

Eight Rorschach variables were investigated as to their ability to discriminate between the therapy outcome groups. These were: prognostic score, human movement (M), animal movement (FM), inanimate movement (m), shading, color, form level, and productivity or response total.

The general findings of this study were that the Rorschach could be used to predict psychotherapeutic improvement in the group studied, but could not be used to predict speech or symptomatic improvement. The Rorschach factors which discriminated significantly (2% level) between those who improved most and those who improved least were the movement variables, M, FM, and m, and the Rorschach Prognostic Rating Scale. These also discriminated significantly (5%

level) between those who continued and those who dropped.[1] The significance test employed was 'Distribution-free Test for 1-factor Experiments' as outlined by Mood (5), a non-parametric technique yielding chi-square with one degree of freedom.

Similar comparisons involving the ratings of symptomatic or speech improvement did not yield significant differences. Retesting of 26 of the 35 initially given Rorschachs showed a tendency to shift downward in prognostic scale value during the therapy, a result to be expected since previous therapy usually decreases probability of success.

From the results of this study, the Rorschach probably should not be expected to predict changes in overt speech behavior. The movement variables, however, and the prognostic score may be successful in sorting out those stutterers who are likely to drop out of therapy early, and in predicting which stutterers will show the most progress along dimensions of psychotherapeutic improvement.

[1]The Improved Most group averaged five M responses per record, while the Improved Least group averaged only slightly over one M per record. Similarly, the other movement variables and the prognostic scores were higher in the prognostically more favorable groups.

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A Personality Inventory Item Analysis Of Individuals Who Stutter And Individuals Who Have Other Handicaps

Francis Walnut

ONE OF THE most controversial subjects in speech pathology is the relationship between stuttering and personality. It is the purpose of this study to shed some light on this topic by investigating the question of whether the personality deviations of individuals who stutter result from the stuttering or whether the stuttering is possibly a result of the personality deviation. Another purpose is to give indications as to the specific areas in which the reactions of crippled, cleft palate, and stuttering individuals may differ from the normal.

The study was designed to investigate the personalities of three groups: (1) Persons who have a speech defect (stuttering) but no known organic disorder, (2) persons who have a speech defect (articulation) and an organic disorder (cleft palate), and (3) persons who have no speech defect but have an organic disorder (crippled).

It was reasoned that the personalities of crippled individuals could not have been the cause of the organic disability but may have emanated from it. The personality deviation of individuals with cleft palates could not have been the principal cause of their speech defect but the cleft and the speech defect might have had a marked influence on the personality development of the individual.

If the personality deviations of stuttering individuals are correlated highly with those of crippled or cleft palate individuals there is reason to believe that stuttering is the effect rather than the cause of the defect. If, on the other hand, no such correlation is found, there is some reason to believe that the personality deviations involved in stuttering were the cause rather than the effect.

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Procedure

The short form of the Minnesota Multiphasic Personality Inventory (hereafter referred to as the MMPI) was administered to 141 high school students or individuals of high school age.

The subjects consisted of four groups: a control group, a group of individuals who stuttered, a group of crippled individuals, and a group of individuals who had cleft palates.

The control group was made up of 52 students in the junior year in the public high schools of Philadelphia. The mean age was 16 years 8 months, with the range from 15 years 10 months to 18 years four months. There were 28 females and 24 males in this group.

The stuttering group consisted of 38 students in the junior or senior years in high school. The sample was

TABLE 1. Ranks of all four groups according to the clinical scales of the MMPI.

	Control Group	*Stuttering Group*	*Crippled Group*	*Cleft Palate Group*
Hypochondriasis	49	42	49	51
Depression	51	53	52	54
Hysteria	53	48	53	52
Psychopathic Deviation	55	45	52	49
Interest (MF)	50	55	49	55
Paranoia	50	54	49	51
Psychasthenia	52	52	49	51
Schizophrenia	56	49	53	50
Hypomania	58	52	52	52

made up of 20 males and 18 females with a mean age of 16 years four months. The ages ranged from 14 years eight months to 18 years no months.

The crippled group consisted of 25 students in the junior and senior years in high school. The sample included seven males and 19 females with a mean age of 17 years six months, and a range from 15 years seven months to 20 years one month.

The cleft palate group consisted of 26 individuals. The sample was made up of seven males and 19 females with a mean age of 17 years six months. The range was from 15 years seven months to 18 years nine months.

Results

There were three specific questions investigated in this study:

1. What differences, if any, exist between the control group and the pathological groups (stuttering, crippled, and cleft palate) on the basis of the norms of the MMPI?

2. What gross personality differences and relationships between the pathological groups and the control group are indicated by an item analysis?

3. Are the behavior differences indicated by the pathological groups of a sporadic nature or are they found in any concentrated areas?

Question 1. The data on the three pathological groups were scored according to the clinical scales of the MMPI, and compared with the norms set up for this test. The control group was also compared in this way. In addition, the scores of the three pathological groups were compared with the scores of the control group on each of the clinical scales of the MMPI.

The results of the tests for males and females were scored separately and a mean was calculated for each scale. The mean score for each group was recorded as a rank according to the instructions in the manual. Since the short form was used, the *k* factor was not used in scoring.

A mean rank was then obtained for each complete group by weighting the rank scores of the males and females by the number in the group, thus giving a mean rank for each complete group. According to the manual a rank of 50 is generally considered normal, and no deviation is considered clinically significant unless it falls above the 70th rank.

Finally, the mean scores and standard deviations for each pathological group on each scale were compared to the mean scores obtained by the control group by a critical ratio test. A critical ratio of two was considered significant.

The results of the analysis of the clinical scales of the MMPI indicate that:

1. When the ranks of all groups were compared with the norms set up by the MMPI it can be seen (Table 1) that all the scores fall well below the 70th rank. This indicates that all of the groups measured in this study fell within the normal range of personality as measured by the MMPI norms.

2. In comparing the pathological groups and the control group in this study the following differences were observed:

a. The stuttering group showed significant differences on the Depression and Paranoid scales (Table 2) and these differences were toward the poor adjustment end of the scale. According to the MMPI manual this would indicate that in relation to others of comparable experience, the stuttering group has (1) 'poor adjustment of the emotional type with a feeling of uselessness and inability to assume normal optimism with regard to the future,' and is characterized by (2) 'suspiciousness, oversensitivity, and delusions of persecution.'

b. The stuttering females deviated significantly on the Interest (MF)

TABLE 2. Means and standard deviations of the scores on the clinical scales of the MMPI of all four groups and the critical ratios between the control group and the stuttering, crippled, and cleft palate groups.

Scale	*Control Group*	*Stuttering Group*	*C.R.*	*Crippled Group*	*C.R.*	*Cleft Palate Group*	*C.R.*
Hypochondriasis	$\overline{X}$ 5.8 S 3.0	$\overline{X}$ 7.1 S 3.4	1.24	$\overline{X}$ 6.0 S 4.0	.18	$\overline{X}$ 6.5 S 5.0	.58
Depression	$\overline{X}$ 18.0 S 4.1	$\overline{X}$ 21.6 S 6.4	2.25	$\overline{X}$ 19.1 S 4.7	.85	$\overline{X}$ 19.6 S 4.0	1.45
Hysteria	$\overline{X}$ 18.3 S 4.1	$\overline{X}$ 18.7 S 4.5	.33	$\overline{X}$ 19.0 S 4.2	.58	$\overline{X}$ 18.1 S 2.3	.20
Psychopathic Deviation	$\overline{X}$ 16.6 S 3.9	$\overline{X}$ 17.7 S 5.6	.87	$\overline{X}$ 14.9 S 3.0	1.49	$\overline{X}$ 12.8 S 3.3	3.45
Interest (male)	$\overline{X}$ 18.8 S 3.1	$\overline{X}$ 22.8 S 4.4	1.55	$\overline{X}$ 20.0 S 4.7	.82	——— ———	—
Interest (female)	$\overline{X}$ 35.1 S 3.5	$\overline{X}$ 30.5 S 5.0	3.41	——— ———	—	$\overline{X}$ 33.8 S 4.1	1.08
Paranoia	$\overline{X}$ 7.8 S 3.5	$\overline{X}$ 10.1 S 4.0	2.17	$\overline{X}$ 8.2 S 3.1	.38	$\overline{X}$ 8.5 S 2.8	.69
Psychasthenia	$\overline{X}$ 11.7 S 7.5	$\overline{X}$ 13.2 S 6.8	.02	$\overline{X}$ 11.6 S 6.3	.00	$\overline{X}$ 11.0 S 7.5	.02
Schizophrenia	$\overline{X}$ 13.2 S 9.1	$\overline{X}$ 13.2 S 8.0	.00	$\overline{X}$ 14.1 S 8.7	.18	$\overline{X}$ 10.5 S 7.0	.96
Hypomania	$\overline{X}$ 17.3 S 4.3	$\overline{X}$ 17.9 S 5.5	.48	$\overline{X}$ 16.7 S 4.0	.60	$\overline{X}$ 16.3 S 4.7	.80

TABLE 3. Chi-square test of independence between the three pathological groups.

	Stuttering Group	*Crippled Group*	*Cleft Palate Group*	*Total*
Items answered *differently* from the Control group	45 (49)	47 (49)	56 (50)	148
Items answered the *same* as the Control group	321 (317)	319 (317)	310 (316)	950
Total	366	366	366	1098

scale toward the poor adjustment end of the scale. No interpretation can be made of this deviation at the present time since no clinical significance has been attributed to this scale for females.

c. The cleft palate group deviated significantly in the Psychopathic Deviation scale, but, since the direction is toward the better adjustment end of the scale, no clinically significant conclusions can be drawn from this deviation.

Question 2. The items answered by the control group were compared with the corresponding items of each pathological group. The answers to a number of items for each group differed significantly from the control group. The gross personality deviations of each pathological group was considered to be indicated by the number of items answered differently. The three pathological groups were then compared in order to determine whether or not there was a difference in the gross personality deviations of the three groups as measured in this way.

A critical ratio between the difference of percentages was used. A difference of two times the standard error was considered sufficient to regard the question as answered differently. A chi-square analysis of the comparative number of items answered differently by each group was used to determine the independence of the three pathological groups.

The results of the gross personality differences as indicated by an item analysis (Table 3) indicate that the stuttering group answered 45 items differently from the control group, the crippled group answered 47 items differently, and the cleft palate group answered 56 items differently. The three pathological groups do not differ significantly from each other as to the number of items answered differently from the control group. Therefore, their personality deviations as measured by an item analysis did not differ significantly from each other.

Question 3. The 366 items of the short form of the MMPI were studied, and it was found that most of the items would fall into 11 areas which were used for this study only. From the 366 items in the test 225 seemed to be concerned with the subject matter that constituted the following 11 independent areas:

Psychological Introspection. Items concerned with the individual's introspections regarding his interaction with his environment (46 items).

Bodily Activity. Items concerned with the individual's statements as to his physiological activities (42 items).

Opinions. Items concerned with the evaluation by the individual of his and other people's behavior (22 items).

Home and Family. Items concerned

with the relations of the individual to his home and family (18 items).

Relations with Other People. Items concerned with the individual's expressed reaction to other people (17 items).

Overt Behavior. Items concerned with the specific behavior in which the individual claims that he did or did not indulge (16 items).

Likes and Dislikes. Items concerned with the individual's expressed likes and dislikes (18 items).

Religion. Items concerned with the individual's reaction toward religion and the church (12 items).

Sex. Items concerned with the individual's attitude toward sex and sex behavior (12 items).

Job Preference. Items concerned with the individual's preference in regard to occupational aims (11 items).

Speech and School. Items concerned with the individual's reaction to speech and speaking situations and his behavior in school and attitude toward school (11 items).

It was determined whether or not the items answered differently from the control group by the pathological groups were distributed uniformly throughout the 11 areas. If any possible deviation from uniformity was observed it was studied.

The chi-square test of homogeneity was used to determine the uniformity of the appearance of items in the 11 areas.

In order to have enough 'theoretical frequencies,' areas had to be combined. The combining was done in order that any possible deviation would be noticed. Therefore, in each group the five areas with the highest percentage of items in that group were compared with the six areas with the lowest percentage of items. If a significant deviation was noticed the areas with the most deviant percentages were removed until there was no significant difference between remaining items.

TABLE 4. The 11 areas in their rank order for the stuttering group according to the percentage of items deviating from the control group, and the chi-square analysis of these areas.

		Items in area	*Items deviating*	*Percentage deviation*
Most Deviant Areas	Speech-School	11	6	54
	Relations with Other People	17	3	18
	Job Preference	12	2	18
	Religion	12	2	17
	Psychological Introspection	40	6	15
Least Deviant Areas	Opinions	22	3	14
	Bodily Activity	42	5	12
	Home and Family	18	2	11
	Behavior	16	1	6
	Likes and Dislikes	18	1	5
	Sex	12	0	0

Chi-square of comparison of least deviant and most deviant areas=3.92. (Significant at the .05 level of confidence with 1 degree of freedom.)
Chi-square of comparison of least deviant and most deviant areas without the 'Speech-School' area=1.62. (*Not* significant at the .05 level of confidence with 1 degree of freedom.)

TABLE 5. The 11 areas in their rank order for the crippled group according to the percentage of items deviating from the control group and the chi-square analysis of these areas.

		Items in area	*Items deviating*	*Percentage deviation*
Most Deviant Areas	Home and Family	18	9	50
	Behavior	16	3	19
	Job Preference	11	2	18
	Sex	12	2	17
	Psychological Introspection	46	5	11
Least Deviant Areas	Opinion	22	2	9
	Speech-School	11	1	9
	Religion	12	1	8
	Bodily Activity	42	3	7
	Likes and Dislikes	18	1	5
	Relations with Other People	17	0	0

Chi-square of comparison of least deviant and most deviant areas = 10.23. (Significant at the .05 level of confidence with 1 degree of freedom.)
Chi-square of comparison of least deviant and most deviant areas without the 'Home and Family' area = 3.53. (*Not* significant at the .05 level of confidence with 1 degree of freedom.)

The removed areas were considered to be areas in which possible deviations occured.

The results of the analysis of the specific areas involving the 225 test items indicate that:

1. The stuttering group deviated from the control group in the specific areas of 'Speech-School' (Table 4). Since all of the items answered differently by the stuttering group in this area concerned speech, it can be said that the specific area of deviation of the stuttering group was in the area of speech. The deviation was uniform in all other areas.

The way in which the 'Speech and School' items were answered indicated that the stuttering group demonstrated a marked inability to handle speech and speaking situations. The items answered differently from the control group by the stuttering group were: My speech is the same as always–*False*; When I am in a group of people I have trouble thinking about the right things to say–*True*; Sometimes my voice leaves me or changes even though I have no cold–*False*; I find it hard to make talk when I meet new people–*True*; I have had attacks in which I could not control my movements or speech but in which I knew what was going on around me–*True*.

2. The crippled group deviated from the control group in the area of 'Home and Family' (Table 5). The deviation was uniform in all other areas.

The way in which the items were answered indicated that the crippled group felt a greater harmony with their homes and parents than did the other groups. The items answered differently from the control group by the crippled group were: I loved my father–*True*; I believe that my home life is as pleasant as that of most people–*True*; It wouldn't make me nervous if any member of my family got into trouble with the law–*True*; My mother was a good woman–*True*; Some of my family have habits

TABLE 6. The 11 areas placed in their rank order for the cleft palate group according to the percentage of items deviating from the control group and the chi-square analysis of these areas.

		Items in area	*Items deviating*	*Percentage deviation*
Most	Overt Behavior	16	5	31
Deviant	Speech-School	11	3	27
Areas	Sex	12	3	25
	Home and Family	18	4	22
	Psychological Introspection	46	10	22
Least	Job Preference	11	2	18
Deviant	Likes and Dislikes	18	3	17
Areas	Religion	12	2	17
	Bodily Activity	42	4	10
	Relations with Other People	17	1	6
	Opinions	22	1	5

Chi-square of comparison of least deviant and most deviant areas=6.11. (Significant at the .05 level of confidence with 1 degree of freedom.)
Chi-square of comparison of least and most deviant areas without the 'Opinions' and the 'Relations with other People' areas=3.41. (*Not* significant at the .05 level of confidence with 1 degree of freedom.)

that bother and annoy me very much —*True*; My parents and family find fault with me more than they should —*False*; The things that some of my family have done have frightened me—*False*; At times I have very much wanted to leave home—*False*; My relatives are all in sympathy with me—*True*.

3. The cleft palate group did not differ from the control group in the area of speech, but they did differ in the areas of 'Opinions' and 'Relations with other People' (Table 6). Peculiarly enough the deviation was in the direction of the control group with a small percentage of items answered differently. This indicated that there was less deviation in these areas than would have been expected with the over-all deviation observed.

Conclusions

1. The stuttering, crippled, and cleft palate groups were well within the normal range of personality as measured by the norms set up with the MMPI.

2. The stuttering group gave slight indications of paranoid and depressive tendencies on the basis of the categories of the MMPI when compared with the control group in this study.

3. The stuttering group did not differ significantly from the crippled and cleft palate groups in personality as measured by an item analysis.

4. In the analysis of the 11 areas set up in this study:

a. The stuttering group gave indications of reacting abnormally to speech and speaking situations.

b. The crippled group gave indications of different reactions toward the home and family. It was indicated that the crippled group felt more harmony in their relationships with the home environment than was felt by other groups.

5. In general, the study did not indicate whether stuttering precipitated abnormal personality or vice versa, since the so-called pathological groups showed no significant personality deviations.

Reference

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Convention Notice

At the ASHA annual convention to be held in St. Louis in October, a three-hour program on stuttering therapy will be held. It is hereby announced that a competition for places on this program is opened to the entire membership. You are invited to submit a 750-word (or less) answer to one or several of the questions listed below. The best answer to each question will be chosen by a committee consisting of Wendell Johnson, Charles Elliott and C. Van Riper. These will then be presented at the convention preferably in person, through a substitute reader, or by tape recorder. The three judges will then justify their choice, evaluating and briefly supplementing. You may send your paper to Dr. Charles Van Riper, Speech Clinic, Western Michigan College of Education, Kalamazoo, Michigan, with a deadline of September first, for distribution to the other members of the judging committee. We invite the membership to contribute their fresh ideas to an old subject.

1. On what basis are we justified in making a differential diagnosis between excessive, dangerous, and abnormal non-fluency in the child and normal non-fluency?

2. Can stuttering or abnormal non-fluency be precipitated by excessive communicative frustration as well as by parental anxiety or mis-evaluation?

3. What release therapy for the young stutterer seems to be most effective?

4. How can we create a favorable speech environment for young stutterers?

5. Desensitization therapy for young stutterers: raising the threshold of fluency breakdown. How can this be accomplished?

6. Is there a need for such concepts as primary, transitional and secondary stuttering?

7. How can we reinforce the normal fluency of the young stutterer?

8. What part do the stutterer's self-concept and body-image play in therapy?

9. How can we best reduce the stutterer's fears?

10. What methods do we have for decreasing tension and tremors?

11. How can we facilitate the reduction or elimination of struggle and contortion in stuttering?

12. How can we create voluntary versus involuntary reactions in stuttering blocks?

13. How can semantic re-education be carried out in public school speech therapy?

14. What techniques for preventing the occurrence of moments of stuttering in the adult are most advisable?

15. How can we solve the approach-avoidance conflicts in stuttering?

16. A new therapy for stuttering?

17. Psychotherapy for the stutterer?

18. Terminal therapy and the prevention of relapse?

19. Prognosis?

20. Public school methods for treating stuttering?

Familial Incidence Of Cleft Palate

Ralph Schwartz

IN PERUSING the literature on cleft lip and cleft palate one is struck with the diversity of figures and opinions concerning incidence and etiology. While there may be said to be broad general agreements, differences are sometimes quite extreme.

Incidence

Figures cited in the literature vary from as few cases as 1 in 2400 births to as many as 1 in 433 births. Between the years 1945 to 1949 De Voss (*8*) found an over-all variability of from 1 in 1182 to 1 in 516.2 per annum. McEvitt, in a recent report (*15*), gives the odds as 1 in 750. Most of the recent figures run between 700 and 1000.

It has long been recognized that there is a racial factor determining some of the variability. Brophy (*2*) found fewer instances among Negroes than whites. Finns supposedly had the greatest incidence. De Voss (*8*), in San Bernardino County, California, found the proportion of cleft palate births almost twice as great among the Mexican population as among the 'White.' Krantz and Henderson (*14*), in Hawaii, found that cleft palate rates differed for unmixed races; they also discovered that the incidence was markedly increased when the mothers were of blended racial ancestry. They concluded, '. . . the incidence of cleft palate is correlated with the number and age of fusion of color fractions in the maternal ancestry.'

Geographical distribution seems to be another variable. Incidence seems to be lower in desert areas, higher in mountain areas, and higher in glaciated areas (*9*). Krantz and Henderson (*14*) found the frequency in Hawaii to be about twice that in Wisconsin and about four times that in New Jersey.

There is an inconstant differential when incidence is related to classification; and a considerable amount of variation in the figures is probably related to just what is considered a cleft palate or cleft lip, or whether other facial clefts or developmental anomalies are included. Morley (*16*) uses a three-way general classification of postalveolar, alveolar, and prealveolar clefts, with subdivisions of each. Some systems are more complicated. The simplest division distinguishes palatal clefts from labial clefts. A common usage is to consider any and all such malformations as a unit category.

One figure cited is that cleft lip is about one fourth as frequent in occurrence as cleft palate (*2, 9*).

According to Gates (*10*):

> Veau (1938) found 60.3 per cent of cases of harelip with and 39.7 per cent without cleft palate; 48.4 per cent of cases of cleft palate with and 51.3 per cent without harelip.

De Voss (*8*) found 17% of his cases had harelip only, 48% cleft palate

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only, and 35% a combination of the two malformations. Hixon (*12*), out of 695 affected persons, found the lip involved in 31%, the palate only in 19%, and both lip and palate in 50%.

The matter of distribution according to sex seems somewhat confused. Some figures show a ratio of slightly less than two males to one female. Other sources claim that the ratio among the sexes is about even, with a slight preponderance among the males. Gates (*10*) contradicts himself concerning this ratio. For instance, on p. 26 he states, 'The sexes are found to be about equally affected in . . . harelip and cleft palate. . . ' He iterates this on p. 29 with the statement that, '. . . Bell (1940) found the sexes equally affected with harelip and cleft palate, 114[m]: 110[f].' Yet, on p. 819 he cites a ratio from one of Sanders' investigations, showing 63.8% boys and 36.2% girls, and states that 'This ratio of nearly 2:1 is in general agreement with all other statistics on the subject.' Other figures are quoted in the monograph which would tend to back up one or the other viewpoint. Kessler (*13*), in his Cleveland investigation, found that 56.9% of the affected children were boys. Other figures cited (*16*) are 56%: 44%, 55%: 45%, 52%:48%—boys to girls. In Hixon's study (*12*) about ⅔ of the subjects were male and about ⅓ were female. De Voss (*8*) gives a ratio of 62% male to 38% female. He also compared the proportion of male to female births in the general population over the investigation period (52:48), but the variation was not found to be statistically significant.

In a breakdown by sex and by classification, Hixon (*12*) found lip involvements nearly twice as frequent in males as in females for both isolated harelip and harelip in combination with cleft palate. Isolated cleft palate occurred about equally between the sexes.

Of direct interest to the purposes of this paper are the statistics on familial incidence. The general consensus seems to be that about 20% of affected cases will have at least one, or more, incidents of cleft lip or cleft palate or other related congenital anomaly in the immediate or related family. The estimates range, however, from 5.7% to 44.5% (*21*). One investigator (*cited, 2*) is reported as finding a 'positive family history' in 95% of over 1000 cases. Brown (*4*) found 10%. Davis (*cited, 4*), reported 15-20%. Padgett (*18*) cites about 25%. Carmody (*6*), in over 2000 cases, found 40% maximum. De Voss (*8*) found 4 out of 30, or about 13%. Ritchie (*cited, 19*) found 34 out of 350.

In historical perspective there seems to be an increase over the years in the general incidence of cleft palate and harelip. While this may be true, and there are perfectly good explanations for such a trend, the increase may be more apparent than real. A simulated rise in frequency may conceivably be due, at least in part, to the following factors: (1) More accurate vital statistics; (2) Laws which require all cases of congenital anomaly, such as cleft palate, to be reported; (3) A greater per cent of conceptions successfully brought to term.

Etiology

It is beyond the scope of this paper to give a detailed consideration to the various theories of causation. A summary statement follows:

1. Mechanical. Various forms of mechanical interference with normal embryological fusion have been postulated: Up-carrying of the tongue, gravitational pressure of the tongue with the fetus in head-downward posi-

tion, amniotic bands and amniotic pressure, interposition of the extremities, tumors, abnormal pressure of the mandible, and hydrocephalus causing broadening of the skull.

2. Maternal impressions.

3. Supernumary teeth. The extra tooth, or teeth, is often an incisor; and Warnekros is said (*2*) to have considered this a sign of an atavistic reversion to the time in man's evolutionary history when he normally had six incisors per arch instead of the present four.

4. Syphilis. Campbell (*5*) advocated this viewpoint as recently as 1947. But Padgett (*18*) earlier had stated: 'Congenital syphilis does not appear in cleft palates more often than in other children.'

5. Order of birth.

6. Size of family. It is implied here that a large number of births, or pregnancies, tends to make cleft palate more likely. One view would interpret it as 'insufficiency of inherent developmental force' (*20*).

7. Regional growth factors due to poor blood supply.

8. Maternal illness. Tendency to miscarriage, etc.

9. Diseases of the fetus.

10. Communicable diseases, e.g., rubella.

11. Intrauterine trauma.

12. Parental age. Neither McEvitt (*15*) nor De Voss (*8*) found this factor significant.

13. Metabolic-Endocrine. Brown (*3*) postulated hypothyroidism as a causal factor. Henderson and Krantz (*11*) countered this with a finding, in Hawaii, of low hypothyroid incidence and high cleft palate incidence. Furthermore, they found that low metabolic rate was not correlated, by group, with relative incidence of cleft palate. Gates (*10*) reports that Steiniger increased the incidence of harelip in a strain of 'harelip mice' by 50% by injecting the females with 'preloban,' an extract of the anterior pituitary.

14. Malnutrition, especially selective factors in the maternal diet or environment. Experiments in the Berlin and London zoos showed that palatal clefts could be created or prevented in lions, tigers, and jaguars by manipulation of the diet, in particular the freshness of the meat (*2, 9, 20*). More recently the work of Warkany and his associates in the manipulation of diet in rats, and that of Ingalls on the effects of anoxia, has received attention (*7, 9, 21*).

15. Heredity. This is the most widely held and best documented hypothesis. Pierre Sylvain Regis (*cited, 18*), in 1690, was perhaps the first to call attention to this factor. All sources reviewed by this writer concede its importance, at least in part. Brophy (*2*) discusses the eugenics of the problem. It is reported (*21*) that Haentzschel claimed all cleft formation to be due to heredity, and that he consequently recommended sterilization of all persons with cleft palate. Both Coursin (7) and Warkany (*21*), however, strongly caution against the holding of such extreme views. Certainly the evidence accumulated to prove the primacy of hereditary transmission is not overwhelmingly absolute. One must reckon with the evidence concerning metabolic, endocrine, and nutritional factors, as cited above. Warkany (*21*) poses an interesting hypothesis: He calls the form of cleft palate developed in his experimental rats through maternal malnutrition 'phenocopies.' The V-shaped pattern of the clefts is consistent and is apparently a mirroring of a normal embryological pattern 'frozen' at a given stage of development. Such a pattern can conceivably be due to hereditary

causes, too. Thus, the cleft in Warkany's rats may be said to simulate a true phenotype. He further posits that what may seem to be a strong hereditary taint, e.g., when a number of children from the same mother are affected, may simply be evidence of a continuing dietary lack in the mother. A distinction between hereditary cleft palate and such 'phenocopies' must be made, then, to avoid giving a false picture of hereditary influences.

Figures on the familial incidence of cleft palate and harelip have been cited in the previous section. Even within a given family most cases seem to occur somewhat sporadically. Strong evidence of direct transmission is sometimes found, however. Genealogies have been quoted by Brophy (*2*), Gates (*10*), and Thoma (*20*). According to the latter:

> Keeler (1935) published the pedigree of a family with 8 out of 15 members affected . . . and cited a case published by Toyama (1909) and one by Masow (1926) in which the harelip was inherited as a unit dominant. In these pedigrees we find that from 8 matings of normal with affected persons, 15 normal and 14 affected offspring resulted.

Strains of mice have been bred in which there is a known element of hereditary transmission of harelip and cleft palate. Beatty (*1*) notes that certain types of domestic animals may have these defects, and claims that veterinarians have stated that cleft palate is more likely to appear in dogs and cats which are in-bred. Concerning humans, Warkany (*21*) points out that 'a high familial incidence of deformities does not necessarily indicate that they are genetically determined . . . On the other hand . . . the occurrence of a pathological trait or a malformation in only 1 member of a family does not exclude the possibility of its genetic determination.'

Variations in the manifestation of the cleft palate–cleft lip syndrome have been noted. Thus, the merest notch may indicate an incipient cleft lip, velar insufficiency may be a modified form of cleft palate, submucous cleft is an anomalous form, etc. A high palatal vault is sometimes looked upon as a cleft palate which did not quite occur. Absence of, or bifid, uvula is suspicious. Other anomalies may be present. The following oro-dental elements have been cited (*19*): macrostomia, fistula of the lower lip, macroglossia, split tongue, tumors of the tongue, supernumary teeth, suppression of one or more incisors, irregularity of the dental arches, stunting of the teeth (especially the incisors). Very often these are considered 'substitute' forms of the manifestations. Orban (*17*) feels that, especially, fistulae of the lower lip may be found in place of harelip.

Cleft lip and cleft palate have probably been associated, in fact or in theory, with just about every other known congenital anomaly–physical, physiological or psychological. Investigators have sought through such association to 'prove' hereditary transmission, or they have sought to determine the mode of such transmission. Inclusion of such accessory anomalies and variants in a study will, of course, influence the figures obtained on incidence of the problem. Various syndromes have been identified in which cleft palate or harelip is but one aspect. Polydactyly, syndactyly, cleft feet or hands, a notch of the lower eyelid, dacrocystitis, club foot, hernia have been associated. Acrocephalosyndactyly, or Apert's syndrome, includes among other skeletal and developmental anomalies and physiological deviations, harelip and cleft palate (sometimes). Cleft palate is sometimes considered to be a stigma of degeneration. There seems to be a slightly greater incidence of mental deficiency

in persons with cleft palate, but the presence of one condition does not necessarily imply the other, nor does their concurrence in one individual imply a relationship. In a study of the skin-muscle-skeletal system (*10*), 44.7% of the anomalies found were harelip and cleft palate. It must be emphasized, as Warkany and his associates show (*21*), that such associated or related problems do not prove the hereditary factor, necessarily. Induction through nutritional deficiency often created other systemic and symmetrical defects, especially of the hands, feet, and mandible.

Any study in human genetics is necessarily complex. The simple Mendelian laws of inheritance can rarely be applied directly. *Degrees* of dominance and *degrees* of recessiveness must be considered, often one factor relative to another. 'Normal overlays,' in which a known dominant factor fails to appear in a given generation, may occur. Mutations, of course, occur; and there may be mutational *shifts* from dominance to recessiveness, and vice-versa. There is an element termed 'penetrance,' which will vary for a given factor in the presence of various environmental influences. Penetrance may be related to sex; and the variable must be distinguished from 'sex-linkage.' 'Expressivity' is a postulated mechanism which seeks to explain some of the variant manifestations of known or suspected genetic factors. The notched lip would be an example of expressivity as applied to harelip; failure of occurrence may be an extreme form, at times. Warkany (*21*) quotes Reed as follows:

> In mice there are differences in harelip expression resulting from the action of both environmental and genetic factors. Differences in harelip expression depend upon the sex of the individual, the size of the litter . . ., the age of its mother, asymmetry of the clefts, and in large part other intangible chance factors.

Inheritance, furthermore, may not be from a unit genetic factor. For any given manifestation it may be necessary to have two or more specific genes present at the same time and operating in a suitable environment. Such multiple genetic factors may differ in dominance, penetrance, expressivity, sex-linkage, etc. It must also be emphasized that non-genetic chance or growth factors may produce manifestations which are what have been termed 'phenocopies,' and which may simulate in their occurrence a hereditary genealogy.

In the study of cleft palate and harelip various interesting genetic hypotheses have been postulated. Sanders (*cited, 10, 21*) suggested that there are five recessive factors required for the normal fusion and growth of the maxillo-facial-labial structures, and that absence of one or more of these determined the type and degree of abnormality. Mode of inheritance was postulated to be recessive in some cases and dominant in other cases; in general, it was felt that the more severe forms were recessive and that only the milder forms tended to be dominant. A double recessive requirement with one gene autosomal and the other sex-linked has been suggested to explain the approximate 2:1 ratio of male to female, especially claimed concerning harelip. Other patterns have been proposed. It is pointed out that there may be a number of genes capable of producing similar manifestations.

Krantz and Henderson (*14*) imply that phenotypic expression of cleft palate is enhanced by something that happens through racial crossing. 'Possibly the penetrance of the determiner is increased.'

In human beings, investigations in heredity are further complicated by the small number of offspring and the often astronomical chance factors of

genotypic transmission. 'It will be seen that the genetics of harelip and cleft palate in man is complicated and far from settled' (*10*).

Whenever a specified characteristic shows a preponderant incidence in one sex as compared with the other, and the ratio shows a fair amount of regularity, as is the case with cleft palate and harelip, hereditary factors are suspected. Although, as has been pointed out, the exact male-female ratio is not clear it can be stated with certainty that there is a slight preponderance in favor of males. The duogenic transmission, with one autosomal gene and one sex-linked gene could explain a 2:1 ratio; but such a ratio would not necessarily follow, being dependent upon matings, proportions of various genes in the general population, expressivity factors, and method of sampling. Thus, considerable variability would be allowed (*10*). According to Csik and Mather (*cited*, *10*), the assumption of a sex-linked gene is not always justified. Greater frequency in males *may* be due generally to 'greater penetrance or greater expressivity of the gene in the male sex.'

The question inevitably comes up as to the incidence of congenital anomalies among twins, and especially monozygotic as compared with dizygotic twins. The picture is not absolute. Fraternal twins with corresponding cleft formations have been reported; although usually only one of a dizygotic pair is affected. Identical twins have been reported who had either identical abnormalities or variant abnormalities. Mirrored clefts have been reported. But most important of all, identical twins have been reported in which one of the pair was apparently normal. In De Voss' study (*8*) only one twin was reported; it was stated to be an identical twin, with the brother having *no* manifestation of cleft palate. A particularly interesting case is reported by Gates(*10*):

> A probable monozygotic thoracophagus, female, joined from sternum to umbilicus, was described by Sangvichien (1937). There was one umbilical cord but one member only had harelip and cleft palate. Such cases are presumably due to a difference in penetrance of the gene concerned.

Warkany and his associates (*21*) reached the following conclusion:

> It seems to us, however, that the existence of reports of 9 pairs of identical twins of which 1 member showed a cleft while the other member was normal in regard to this deformity proves that nongenetic factors are also involved in the formation or prevention of harelip and cleft palate.

Procedure

Unless otherwise specified, the term 'cleft palate' is hereinafter used to mean all forms of velar insufficiency, clefts of the hard and soft palates, holes in the palate, alveolar clefts, and all degrees of labial clefts, either alone or in combination with other forms.

The present study surveyed the records of cases in the files of the Institute of Logopedics, Wichita, Kansas, in order to determine the familial incidence of cleft palate. At the same time other information was obtained.

A tabulation check-list was prepared, yielding for each subject the following information: case history number, sex, presence of cleft palate, presence of cleft lip. Three sections were concerned with family members. The first of these sections was a list of siblings. Half-brothers and half-sisters were included since there was a direct blood line; stepbrothers and stepsisters were not listed. The second and third sections represented the paternal and maternal branches of the family. For both of the last two sections mother and father were always

designated; but *only* those other relatives who were reported to be afflicted with cleft palate were listed.

Information on sex distribution, type of lesion, and familial incidence was obtained. It was noted whether the subject had both cleft palate and cleft lip. There was no distinction made among family members, however, as to whether one or both conditions was present.

A control group of 100 cases, designated non-cleft palate, was chosen at random from the case history files; and a comparison was made between the familial incidence to be found in the 'cleft palate' group and that of the control group. The statistical method used in making this comparison was that of the probable error of the difference between two proportions, and the critical ratio derived therefrom.

Data and Discussion

As of January 1, 1953 the Institute of Logopedics had examined 235 persons whose problem was subsequently classified as 'cleft palate.'

Sex Distribution. Numerically, there were 139 males and 96 females, or about 59% male and 41% female. This is a proportionate relationship, male:female, of 1.45:1.

It is evident that the sex ratio found in this study is comparable to that found in other studies. Bell (*cited, 10*) found in his 1940 study that 50.9% were males. Lücker's figures (*cited, 10*) yield 54% males. Kessler's Cleveland investigation (*13*) cited 56.9% males. In one of Sanders' studies (*cited, 10*) there were 63.8% boys. Hixon (*12, adapted*) in Ontario, in 1951, reported 65% male and 35% female. De Voss (*8*), in a 1952 report, found 62% males and 38% females. The present study achieves a sort of median relationship to the other reported material.

To achieve the 2:1 ratio which is so often quoted would require a percentage relationship of 67% male to 33% female. Only Hixon's study seems to approach this. The ratio derived from his figures is 1.83:1. That from Sanders' study is 1.7:1. The 2:1 ratio seems too high on the basis of known information. It is suggested that a more reasonable figure would be about 1.5:1. Thus, one could reasonably claim that there are about 1½ times as many males as there are females affected by cleft palate. An average of 60% male and 40% female might also be postulated. These percentages are in agreement with the known published figures, and they also coincide with the suggested 1½:1 ratio.

Extent of Anomaly. Cleft palate in combination with cleft lip was found in 123 cases. Cleft palate alone was found in 112 cases. In terms of percentages this means that the combined anomaly was found in 52⅛ per cent and that cleft palate alone was found in 47⅞ per cent.

The percentage figures approximate those of Veau (*cited, 10*), although in inverse relationship. Veau found 48.4% of cases of cleft palate with and 51.3% without harelip. They also approximate De Voss' findings (*8*). He reports 48% isolated cleft palate, 35% combined harelip and cleft palate, and 17% isolated harelip. There is both an agreement and a discrepancy in comparison with the figures cited by Hixon (*12*). Fifty per cent of his cases had a combined anomaly, but only 19% had an isolated palatal defect; 31% had harelip only.

No instances of isolated cleft lip were found in the present study, at least not for the 'experimental' group. Some of the discrepancy between the percentages found in this investigation and those found in other studies can probably be explained as the result of this lack. The paucity of cases exhib-

iting harelip alone can probably be attributed to the source of the information. It must be remembered that the Institute of Logopedics is a center for the correction of speech defects. Since the effect on the learning and production of speech of the unit anomaly of cleft lip, even poorly repaired, is negligible, such cases are not likely to be encountered in routine clinical speech practice.

Familial Incidence. In this portion of the study there were only 227 cases. Eight cases had to be discarded because there was no information available about the family background. A total of 453 siblings was reported; this is an approximate average of 2 per subject, although the range is 0-11. All 454 parents were counted. There were 42 other relatives, outside of the immediate family, presumably evidencing cleft palate. This produced a sum total of 1176 subjects to be considered.

In the control group, there were 100 cases; 212 siblings were involved (again, approximately 2 per case); 200 parents were represented. Only one person outside of the immediate family was reported as having cleft palate. This yielded a total of 513 subjects to be considered in the control group. It is interesting to note that the number of cases in the control group is slightly less than half of those in the experimental group, and the total number of subjects in the control group is also about half that of the experimental group—thus a comparable relationship is consistently maintained throughout.

In the experimental group, 35 cases reported 51 cleft palates occurring in other members of the family; 42 of these occurred in relatives, near or distant, who were not members of the immediate family. Of this number 24 were related through the paternal branch of the family; 15 were related through the maternal branch of the family. In three instances the parental relationship could not be determined on the basis of the information available. Two cases were reported in which the father had cleft palate. In one case the mother was affected. Six siblings manifested the anomaly.

In the control group only two cases reported cleft palate occurring in two other members of the family. Cleft palate in the father's sister accounted for one of these. In the other instance the mother was reported to have both cleft palate and cleft lip.

On superficial examination there would seem to be an obvious discrepancy between the familial incidence within the experimental group and that within the control group. In terms of percentages: 4.34% of the cleft cases showed familial incidence, whereas the controls showed .39%. In terms of ratios, cleft palate occurred in the experimental group in 1 out of every 23.06 births, and in the control group in 1 out of 256.5 births.

The probable error of the proportion found in the experimental group (PE_e) is as follows:

$$.0434 \pm .6745\sqrt{\frac{(.0434)\ (.9566)}{1176}} = .0434 \pm .0040$$

PE of the control group (PE_c) is as follows:

$$.0039 \pm .6745\sqrt{\frac{(.0039)\ (.9961)}{513}} = .0039 \pm .0019$$

The probable error of the difference between the two proportions yields the following: $.0395 \pm .00641$; with a critical ratio of 6.16.

An examination of the figures given above discloses that the PE_c lacks the margin needed for statistical significance. The critical ratio seems large enough, however, to cover any possible variation in this PE_c.

In the experimental group, 4.34% incidence is considerably below the approximate average figure of 20%

(derived from the literature). It is also less than the lowest reported percentage, published by Stobwasser in 1883 (*cited, 21*), of 5.7%. Three possible explanations may be postulated: (1) No cases of isolated harelip are included in the present study. It is conceivable that hereditary factors are stronger in this group than in either the group represented by isolated cleft palate, *per se*, or the combined anomaly. (2) No consideration is being given in this study to 'microclefts' or to the syndromic or hereditary tie-in of other congenital anomalies. Inclusion of these factors might increase the incidence. (*3*) The information available in case histories is often inaccurate, and at best may be vague; this is especially so where a period of time has elapsed since the occurrence of an event and the giving of information, or where conditions are reported in the family. In the present investigation three items of possible familial incidence had to be omitted because information was inadequate. On the history of case No. 9563 was found the comment, 'Child's father's family have had double palate.' It was assumed that this indicated cleft palate; but the number of such persons so afflicted and their relationship to the child remains unknown. There was therefore at least one such incident, although probably there were more than that. An assumption of cleft palate was also made with case No. 11737 where the term 'palate difficulty' was used; however, it is recognized that this may be an erroneous assumption (*e.g.*, it may indicate palatal paralysis or velar nystagmus). Other inferences also had to be made, and some of these may have been in error. Thus, the familial incidence as reported in this study may actually be greater, or it may be less. Such deviations probably do not appreciably affect the statistical significance of the study.

The frequency of cleft palate in the control group should, theoretically, approximate that to be found in the general population. Viewed in this way, the incidence seems too high. A ratio of 1 in 256.5 births is just about three times as great as the 1 in 750 chances claimed by McEvitt (*15*). A larger control sample might have resulted in a smaller frequency. On the other hand, the population source itself may be representative of a skewed sample. This is reasonable when one remembers that the people who come to the Institute of Logopedics come because they deviate from the 'normal' in at least one particular, speech; and it is possible that the sum total of factors (particularly hereditary or congenital) which has caused the speech deviation may contain some of the same factors which preclude cleft palate, or it may be simply an accident of chance sampling. It should be pointed out that an incidence of .39% is not unheard of, even in a 'normal' sample (although not wholly unselected). Krantz and Henderson (*14*) found that among the groups representing racial blends in Hawaii percentage frequencies ran as high as .41% and even .56% (Filipino blends).

Twins. Two pairs of twins were involved. In each instance one twin had a cleft palate, while the sibling twin was normal. Since in each case the sex was the same (male), there was some chance that monozygotic twins were concerned. Obviously, some environmental factor had been operative here, either to cause the cleft or to prevent its occurrence.

Linealogies. In any consideration of hereditary factors it is interesting to have linealogies. There are a few to be found in the files of the Institute; but the relationships are often quite distant:

1. Four familial incidents, all pa-

ternally related. Paternal grandfather's great uncle and uncle; and father's cousins.

2. Two familial incidents. Father's cousin. Mother's nephew.

3. Two combined cleft palate and harelip. Branch of family unstated.

4. Two incidents through the father's mother's sister's branch of the family (her son and grandchild).

5. Three incidents related through the father. His mother's sister's child. Two of his father's brother's children.

6. Two closely related maternally. Mother's father, and her sister's son. (Child involved, incidentally, also a male.)

7. Two related via the mother's mother.

8. Two familial incidents. One maternal. One paternal.

9. Sibling. Opposite sex.

10. Two siblings. One of the same sex and one of the opposite sex.

11. One sibling of the same sex and one second cousin of the opposite sex. It is not known whether the cousin is maternally or paternally related.

12. One sibling and one familial incident. The sibling is of the opposite sex and is the only sibling reported. The other incident concerns the mother's brother.

13. One sibling and one familial incident. Both sibling and familial relationship are the same as in (12), except that here the sibling is of the same sex.

14. Sibling, of the opposite sex. One of six siblings of case. (Through a clerical error the writer failed to 'pull' this case as an example of familial incidence. It was discovered after all computations had been made. Its inclusion in a re-computation would serve only to strengthen the findings of this study.)

The most instances found in any one family were five, including the case himself. Three siblings were involved in another family; but four more siblings were normal.

Summary

The literature is reviewed concerning the general incidence of cleft palate. Incidence is also related to such factors as race, geography, classification, sex, and family. A listing of various concepts concerning etiology is presented; special attention is given to the subject of heredity.

A survey of cases of cleft palate from the files of the Institute of Logopedics is presented. Findings were, briefly, as follows:

Total number of 'cleft palate' case histories: 235.

Sex distribution: 139 males; 96 females. 59% male; 41% female. Proportions, male to female: 1.45:1.

Extent of anomaly: Cleft palate and harelip, 123 cases, or 52⅓ per cent. Cleft palate alone, 112 cases, or 47⅔ per cent. No cases of isolated harelip.

Familial incidence: 35 cases reported 51 incidents. Forty-two incidents occurred in relatives other than the immediate family; 24 of these were paternally related, 15 were maternally related, and 3 were indeterminate. Two fathers were afflicted, one mother, and six siblings.

Familial incidence of 227 cleft palate cases is compared with that of 100 non-cleft palate cases. Familial incidence in the cleft palate group was 4.34%; that in the control group, yielding only two instances, was .39%. For the first group incidence was 1 in 23.06 births; for the control group it was 1 in 256.5 births.

Some 'linealogies' are presented.

Conclusions

1. There is considerable confusion in the literature concerning the incidence of cleft palate. Part of this is related to accuracy of source materials.

Part of it is related to the diversity of approach used by different investigators. Certainly, part of the variability in figures cited is due to the segmental nature of the investigations.

2. In any given population sample, in which a reasonably large number of cleft palate births are recorded, more incidents of the anomaly will be found among males than among females. The average ratio will be 1.5:1. Percentagewise this is a 60:40 ratio.

3. Cleft palate occurs in the families of cleft palate cases more often than in the families of non-cleft palate cases. This difference in familial incidence has statistical significance.

4. Heredity plays an important role in the etiology of cleft palate. The exact mode of transmission is unknown.

5. Environmental factors, in particular maternal metabolism, endocrine balance, and nutrition, are also important. They may be etiological factors, *per se*, or they may be modifiers of heredity.

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An Analysis Of An Exceptional Case Of Retarded Speech

George O. Egland

OCCASIONALLY, cases of speech retardation do not respond to ordinary methods of treatment. Special problems, contraindicating ordinary techniques, make it difficult to find approaches adapted to the special problems which are present. For this reason the following case is presented. Although it is unique in some respects, the basic normalcy of the needs and processes involved in speech development are clearly recognizable.

History

Bobby, the subject of this report, was born September 25, 1948. His birth was three months premature and followed loss of amniotic fluid four days before delivery which, in turn, followed labor of approximately eight hours. Birth weight was two pounds and ten ounces. Oxygen was given for about two weeks of the two months he remained in incubation. Transfusions were also given during this critical period to provide blood elements. The Rh factor was not involved.

Bobby's abnormality, first noticed four months after his birth, was later diagnosed to be retrolental fibroplasia and cerebral palsy evidenced in mild rigidity of the lower extremities with cerebral atonia of the quadriceps. Crawling, standing and walking were not attained. Sitting without support and a few vocalizations, such as 'mom-mom' and 'da-da,' were observed at approximately 18 months, but speech failed to progress beyond this point. Characteristically he was quiet, passive, patient and contented, having limited social experiences and showing the effects of a home in which he was loved and conscientiously cared for.

Treatment

At the age of three Bobby was admitted to the Children's Hospital School on an out-patient basis. His treatment schedule included physical therapy, occupational therapy, and speech, for a half-hour period each three times a week. He was brought to school by his mother who not only helped in his adjustment to the new situations but also learned various principles and practices which the therapists adapted to his program of home management. The importance of his parents' understanding and their extension of treatment within the home, must be remembered in all evaluations of Bobby's case. It is doubtful that speech therapy which Bobby received at school would have been sufficient had it not been for the reinforcement provided at home.

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Whereas the school took the lead in pointing out his specific needs and in adapting techniques to fulfill them, the practical application became, as usual, the responsibility of parents.

Initial Period. Upon enrollment it was evident in all school situations that Bobby was apprehensive and insecure in a quiet, passive, yet alert manner. The only vocalization which was observed during his early days at school was a low whimper. Although he sat quietly with head bowed and fists in eyes, he gave the impression of being intently alert and eager to unravel the many mysteries of unseen stimuli impinging upon him.

The first goal was to establish rapport and to build security in therapy situations. Early therapy was simplified and made as pleasant for him as possible, with distractions, strangeness and inconsistency kept at low levels for this sightless boy. During the first several days in therapy, Bobby was affectionately held on the therapist's lap while a pleasant, casual and simple conversation was carried on between his mother and the therapist. Daily regularity of procedures was an aim in these early stages of therapy in order to establish a basal level for his security, understanding and responsiveness. Identification with his mother and her role in augmenting his favorable anticipation of activities were undoubtedly important during this period.

Responsiveness was limited and gradual. First, he began to smile and reach toward the clinician when therapy session was to start. Being rocked and bounced on the clinician's knee produced smiles and giggles. Such giggling, however, occurred spontaneously only during the pleasurable movement which stimulated it. Parallel giggling by the clinician was unsuccessfully practiced in an attempt to transfer it to a more socialized plane. Attempts were also made to fix the words, 'more' and 'bounce,' spoken by the clinician. It was evident that these and other word cues became understood by Bobby who reacted to them by smiling and shifting of posture.

Second Period. The next therapy step, lasting three weeks, involved repetitious associations of tactual and auditory experiences of objects with simple sounds and single words spoken by the clinician. The more familiar parts of the body were verbalized in interesting fashion by the clinician at the same time that they were touched or manipulated. It was seen by his silent gestures that he already understood the meaning of various words, such as nose, ear, hair, eye, mouth, shoe, finger and tickle. Non-personal objects were gradually brought into the therapy situation. A ball, bell, paper, water and other items were familiarized through auditory and kinesthetic cues and were associated with simplified verbalization by the clinician. Water and paper, which held the greatest interest for Bobby, were utilized most intensively. Desire for these favored objects was stimulated, and an unsuccessful attempt was made to link these immediate incentives with vocalization. In all of these situations it was evident that Bobby was readily learning to identify and discriminate objects, actions and symbols; but smiles and gestures still continued to be the nearest approaches to communication.

Third Period. Because of the fact that giggling had been the only vocalization which had been observed in speech therapy situations, the next

stage in therapy with Bobby employed giggling. Bouncing on the knee had been the only observed stimulus to elicit giggling, so the next two rather strenuous weeks of therapy utilized playful variations of bouncing. It was found that spontaneous giggling and sometimes laughter resulted from unexpected alterations of the tempo, pattern and intensity of bouncing. Non-manipulative means to stimulate Bobby to vary the vocal pattern of his giggling were unsuccessful. He showed no tendency to imitate vocal variations uttered by the therapist. So far in therapy, giggling continued to be the only vocal response, spontaneous and stereotyped in nature and specific to the personal pleasure of being bounced. Giggling tended to diminish as the novelty diminished. In the course of bouncing, however, rib-tickling, which also caused Bobby to giggle, suggested itself as another means to stimulate vocal behavior.

Fourth Period. During the next three weeks speech therapy centered about a method of mechanically stimulating vocalization. Bobby was placed in a supine position on a physical therapy table. The clinician, standing alongside the table, placed his hands in the position used in the Schafer method of artificial respiration, except that with Bobby the pressure was anteriorly rather then posteriorly applied. An incentive to initiate giggling was given by a tickle to his ribs, while variations in the pressure on his thorax created corresponding variations in sound. In turn, novel variations which were produced upon the vocalized stream of giggling had an immediate cyclic effect upon Bobby. Before the first short session was over, he was reveling in the newly found fun of his voice and its unique possibilities. It was evident that amusement from the sounds he made was sharing the stimulus value of being tickled. For the first time in therapy he was having obvious fun with sounds, new and strange and funny sounds, his sounds, sounds over which he was tasting control.

A therapy sequence, related to this discovered lead, was organized and carried out as follows:

Initial Stage. The first aim was to give Bobby wide, random, repetitious experiences in exploring and practicing his vocal potentials, relying less on mechanical stimulation and manipulation by the clinician. During this two-week period, auditory stimulation by the clinician was omitted, no auditory standards being imposed upon his babbling during this period. Some guidance was provided by the clinician kinesthetically, however, in order to help him more readily attain some of the vocal positions. For example, a little manipulation of his lips and jaw was given to help in the discovery and rehearsal of such lagging sounds as [p b f k v g ʃ].

Second Stage. The second period, lasting about a week, was a continuation of the previous exploration and practice but with parallel auditory stimulation added by the clinician. Vocal play at this point became a social game in which either Bobby or clinician imitated the sounds or syllables expressed by the other. It was noted that the need for mechanical manipulation quickly diminished at this point of therapy, probably due not only to the raising of vocalization to a more social level, but also to the fact that an effort was made to wean him from reliance upon mechanical stimulation. Manipulations were diminished in intensity and were inter-

rupted for increasingly long intervals as his vocal self-reliance developed. Finally, only token pressures were needed to start vocal play and experimentation.

Third Stage. Hereafter, Bobby left the supine position on the therapy table and carried out his speech program without mechanical pressure. For transition Bobby was held on the therapist's knee where an occasional bouncing movement supplemented his vocal momentum. Play gestures and handling of various familiar objects were associated repeatedly with appropriate utterances. Rolling a ball, bouncing a ball, rattling a rattle, splashing water, slapping with hands, and touching body parts were samples of meaningful activity around which simple sound patterns and words were interestingly built. Bobby began to say these words of his own accord and to use them socially not only in speech therapy but also in other situations at school and at home.

Terminal Therapy

During the remainder of this first year of out-patient work at school, Bobby's speech development definitely followed an accelerated normal course. Fine cooperation with his family provided him with plenty of meaningful experiences tagged with appropriate speech symbols. Initiative in speech was insured through a program which stressed the personal and social rewards from his vocal activity.

At present, after another year of regular work at school, together with a year of valuable family experiences, Bobby has a large vocabulary, is freely talkative, speaks sentences, and employs speech in all its normal functions. Being sightless and as yet not to the point of self-locomotion, his progress is all the more remarkable. It should be emphasized that credit, beyond that which Bobby deserves, is due to the integrated way in which parents and all staff members at school have worked together. In addition, Bobby is learning by himself to utilize an increasing number of auditory and tactual cues which are unused or overlooked by persons with sight.

Summary

Bobby's acquisition of speech followed the ordinary principles in speech development of any child. His failure to fulfill the usual infantile stage of babbling and vocal play reflected a combination of factors which are important in this stage of development. Vision and locomotion, as tools of stimulation, exploration and confirmation, were absent in Bobby's case. Speech readiness and the reciprocities needed for speech growth may have been unwittingly hampered by the type of management which Bobby received during his first years of life. His mother reports that he had always been on a regular schedule, that his wants were supplied, that he never fussed, that he was an unusually passive, well-behaved child. Ironically, this conscientious and efficient care may have partly defeated its good intentions so far as speech development was concerned. It is possible that this case illustrates a subtle but obstinate type of retardation which might result when a physically handicapped child is subjected to a carefully controlled regime and isolated from stresses and rewards of communication.

At the age of three, Bobby, like other cases who are non-vocal but nevertheless have learned to understand speech, may have outgrown in-

fantile enjoyment of meaningless babble and become too sophisticated in language comprehension to stoop to relatively lower but essential levels of vocal production. A skipped stage of readiness, which may be difficult to revive, often becomes more difficult as time and other maturities progress onward. In Bobby's case it appeared that a subjective type of appreciation for babbling had to be provided, strong enough to counteract his fixed outward attentiveness to an unexplored and perplexing world. With Bobby a manipulative trick stimulated this lost appreciation and lagging insight into his vocal and verbal possibilities. Once started, the pleasant experience of sounds and their mastery grew normally into widening rewards from speech: communication, social control, and personal adjustment.

The Classroom Teacher's Activities And Attitudes Relating To Speech Correction

Gretchen Wright Lloyd
Stanley Ainsworth

ALTHOUGH classroom teachers have always been in a position to help the child with defective speech overcome his problem, they have usually found that their time and capacities are limited. Knudson (*1*), for instance, concluded that a large majority of the classroom teachers interviewed regarding oral recitation problems of stutterers considered themselves inadequately trained to meet this problem. If speech correction programs are to be successful, however, the cooperation of the classroom teacher must be secured. It is reasonable to assume that the ease with which this cooperation may be secured and the degree to which it may be expected will be related to the knowledge and training of the classroom teachers and to the attitudes they now hold. In order to determine this status of speech correction as it exists in the minds of classroom teachers, the finding of answers to certain questions should be of considerable assistance. What is the classroom teacher doing and what is her knowledge about helping the child with the speech handicap? What are the attitudes of the teacher toward doing this type of work? What does the teacher know concerning the activities of the speech correctionist?

In order to answer these questions this investigation attempted (*1*) to discover what the classroom teacher is doing to help the child overcome his speech problem, (2) to find the extent of speech improvement activities carried on in the classroom, (3) to determine how the classroom teacher feels about (a) carrying out suggestions offered her in helping the child with the speech problem, and (b) the limitations of her ability to do speech correction work, and (4) to discover the amount of speech correction training and background information of the classroom teacher.

Although there is a substantial body of literature that has been prepared by public school correctionists for the understanding of speech disorders and techniques which could be used by parents and teachers, we cannot assume that this material has been effective in increasing the quantity and quality of speech work in the classroom. It is possible that such an assumption is not warranted for three reasons: The teachers may not have read the mate-

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rials; the teachers' backgrounds may not have prepared them for an adequate understanding of the materials; they may not be inclined to follow the advice to any substantial degree. This last reason involves attitudes of teachers toward speech correction. Just how much can we expect the teacher to cooperate? Van Riper (2) has stated that the speech correctionist can expect real cooperation from very few teachers. The present study was designed to find some facts about the activities and the attitudes of classroom teachers in regard to speech handicaps.

Procedures

In order to obtain the information desired for the study, the interview technique was used. There were several reasons for this. In a face to face situation with the teacher, it was believed that the answers secured would more truly represent the actual situation. The questions would all be interpreted in the same light since any ambiguities could be cleared up on the spot by the interviewer. Thus, accurate data could be more quickly and efficiently collected by this method.

An interview form was arranged to provide a convenient, stable pattern which did not fluctuate seriously from teacher to teacher. The content of this form was drawn from the articles and books which presented what correctionists believe is helpful for classroom teachers. Questions were asked regarding the following general topics: The teacher's knowledge of the work of the speech correctionist in the schools; her methods of diagnosis of speech problems in the classroom; the teacher's conferences with parents and children regarding speech problems; speech improvement activities; the teacher's knowledge and treatment of articulation problems; the teacher's knowledge of stuttering; teacher's knowledge and treatment of voice problems; referrals made for children with organic speech problems; her college training in speech correction; the reading that she has done regarding speech correction; whether or not the teacher has had her own speech examined; and certain attitudes of the teacher concerning speech correction. The above list is in the order in which they appeared in the interview. The questions regarding the attitudes appeared last because the teacher often reflected her attitude in answering other questions throughout the interview.

Fifty-five teachers were interviewed. They represented the first three grades of rural, small town, and city school systems. The first three grades were chosen because more speech problems are evidenced in these grades. Thirty-four of these teachers were in schools where there was a correctionist, and 21 teachers were in schools where there was not a correctionist. Eighteen schools were represented by the teachers interviewed. Two different counties in Ohio were chosen as areas for conducting the interviews. These places were chosen because there were schools with and without speech correctionists and the distribution of the population ranged from a large city to completely rural areas. In 12 out of the 18 given schools, all the teachers in the first three grades were interviewed. In the remaining six schools, satisfactory time schedules for the interview could not be arranged with three teachers in two of the schools. In the other four schools, the Superintendent qualified permission for the

interviews with the provision that the Director of Special Education should arrange the details of the interview with the principal and the speech correctionist of the teachers interviewed. It was also requested that only one teacher from each grade be interviewed.

The questions were given as nearly the same as possible to each teacher, but the conditions did vary. The emphasis was placed on having the teacher understand the concepts involved rather than presenting a standardized questionnaire. This method provided the probability of securing data which represented the true situation. The time of the interview was generally about 25 minutes. Permission to conduct the interviews was obtained from the principals in every school before any teachers were contacted. The teachers were then seen individually in order to explain the purpose of the interview and to secure a time for the conference.

Due to the nature of the information that was to be obtained, the extent of the activities and attitudes secured may be misleading because of the teachers' desire to be thought of as superior educators. Thus, the degree to which favorable answers were secured may not be reliable, and the possible bias in a favorable direction needs to be considered in any interpretations of the data. If any tendencies in an unfavorable direction are to be noted, however, we can be fairly certain that conditions are *at least* as undesirable as the interview results indicate.

It should be pointed out that this study was not concerned with the efficiency or caliber of the speech correctionists in the schools represented. Since only five correctionists were involved, any conclusions regarding these aspects would be questionable. It is possible, however, to make recommendations regarding factors to emphasize in the training of clinicians from the responses of the classroom teachers.

Findings

Fifty-five teachers in two counties were interviewed concerning their knowledge of, activities in, and attitudes toward speech correction. Thirty-four teachers were from schools which employed a speech correctionist; 21 were from schools that did not have a correctionist. If the answers of the 55 teachers are typical, we may assume that the following statements are representative of classroom teachers activities and attitudes relating to children with speech difficulties.

1. Teachers know very little about the activities carried on by the speech therapist. This was indicated by the fact that only one teacher out of the 34 in schools having a correctionist knew what the therapist did on her job.

2. Correctionists cannot assume that the majority of teachers will refer to them even the speech cases of which the teacher is aware, since 27 per cent failed to do so.

3. Teachers report speech progress and supply case history material in an erratic and unsystematized manner. This was supported by the evidence that only half of the teachers gave reports and case history information to the speech correctionist regarding the child who was having help with his speech.

4. Teachers lack training in speech correction. This was borne out by many facts. Fourteen teachers had had courses where instruction in speech

correction for classroom use was given. Only 19 had read material written pertaining to speech correction for the classroom teacher. Forty-eight of the teachers reported that they either did not know what was available in the school library pertaining to speech correction or that nothing was available. Only one teacher used standardized tests to determine the presence of defective speech.

5. Teachers do not try to build acceptable attitudes in the classroom for the child with a speech problem. Half of them reported no affirmative answers to questions which would reflect this.

6. A total of 49 teachers stated that they do not spend time on speech improvement activity by itself, but the majority of them combine it with reading. Speech activities are common, but they are not directed toward specific improvement.

7. Approximately 75 per cent of the teachers report giving help to children with articulatory problems. This action, however, appeared to be erratic. The main methods of emphasizing correct speech in classes were by stressing sounds the letters make, and by imitation of defective sounds when they occurred. The teachers tried to help the child hear the difference between the good and bad sound by imitation, but since teachers seemed to be confused as to what acoustic process is taking place when they hear a speech defect, their attempts to help the child in these ways are apt to be misguided. This confusion was reflected in the answers to questions about therapy for articulatory problems. Only half the teachers believed that they could describe what the child does when he makes a sound the wrong way. About half the teachers thought they could imitate the defective speech of the child. Yet, 43 said they tried to help the pupil hear the difference between the good and bad sound by imitation.

8. About three-fourths of the teachers manifest some basic understanding of the problem of stuttering. They reported that they did not believe in arm swinging, whistling or some device to prevent stuttering, that they remained calm and looked at the child when he stuttered, did not tell him to stop and take a deep breath, and waited for him to complete his entire speech before interruption. Four teachers did report employing some educationally unsound principles, however, in that they told the stutterer to take it easy and go slowly, complimented him when he was fluent with his speech, and supplied him with words when he got stuck. None of the teachers said that they did not know anything about stuttering.

9. In regard to voice problems, there is little emphasis on correction techniques. Forty-one of the teachers did not ask the child to repeat if he was not heard the first time. Only seven teachers attempted to help the child with a voice problem.

10. Most teachers refer the children with physical deformities which interfere with speech to the proper authorities for medical aid, but 21 of the teachers were not convinced of the need for doing so.

11. Very few of the teachers have had their own speech examined unless this has been part of their formal education. Of the 22 who had had speech examinations, all but two were done in the last 10 years. It appears, then, that some teacher-training institutions are now realizing the importance of

the speech of the teacher and are testing the prospective teacher's speech to guard against any defect which might be present.

12. The presence of a speech correctionist does not insure the increase in speech activity or improvement in attitudes of the teacher. This is supported by the fact that 27 of the teachers in schools where there was a correctionist did not have conferences with the child and the parents of the child who has speech problems. Only eight teachers in the schools without correctionists failed to have conferences. Teachers in schools where there was a correctionist expected more of her than did teachers in the other schools. Teachers in schools where there was not a speech correctionist spent an estimated mean time of 38 minutes per week with the individual child who had a speech problem while teachers with a correctionist in the school spent an estimated mean time of 32 minutes per week with the child. On the other hand, the presence of a speech correctionist may have some favorable effect on the teachers in the schools since 21 of them reported spending a mean time of 21 minutes per day on speech activity. The teachers in schools without a therapist spent an average of 12.5 minutes per day on this activity.

13. Teachers are aware of their general inadequacy in speech correction. Fifty-four of the teachers felt that they were untrained to do one or more of the following items: work with stutterers, give individual help on articulation cases, give general speech help to children with speech problems, work with severe speech cases, imitate defective speech of child, describe what the child does when he makes the sound wrong, help child with voice defect, and give speech tests and make diagnoses.

14. Teachers feel that speech correction work is useful and necessary because 52 of the 55 interviewed answered 'yes' to these questions.

15. Attitudes are favorable for extensive education of the classroom teacher regarding speech problems. This was borne out by results indicating that they are aware of inadequacy but feel that speech correction work is useful and necessary. Also, all the teachers reported that they did speech correction work because they wanted to and not because it was required by the administration. Thirdly, teachers reported carrying on a number of speech activities in their rooms.

Implications of the Study

The results of this study have some important implications for the training of speech correctionists and the speech education of the classroom teacher.

It is clear that teachers are ready to function more effectively in regard to speech problems. They are generally aware of their inadequacies, and yet feel that speech correction work is useful and necessary. There is little evidence that they would be resistant to efforts to help them do a better job.

The obvious answer to this is that they need more training. It seems reasonable to expect this training to come from two major sources: First, teacher training institutions need to make such courses available to teachers. This should be done on an extension, workshop, and short course basis, as well as in the regular curricular offerings, in order to reach the teacher already in the field. Second, the speech correctionist on the job must supply the bulk of training to teachers in the

field wherever possible. This, in turn, implies that the training of the speech correctionists must contain greater emphasis on the significance of and techniques for classroom education. The importance of this aspect is pointed up by the evidence that teachers generally wish to turn all speech correction work over to the clinician as soon as she appears on the scene. It is only natural that busy teachers should wish to be relieved of this function about which they feel inadequate. Certainly it will take a considerable amount of diplomatic and educationally sound training on the part of the clinician to make teachers accept the more nearly ideal method of cooperative attack on speech problems.

A third source of training which needs particular consideration is the material which is written regarding speech correction for the classroom teacher. In this study, articles, books, and pamphlets were not effective in assisting the teachers to change their attitudes. They have not read them, but even if they had, there is evidence that they would reject many of the suggestions provided by the correctionists on the basis of lack of time or training. If further writing of this type is to be done, it should take the direction of pamphlets to be distributed wholesale or directed into periodicals which teachers actually read.

This type of study might well be repeated in various parts of the country in order to determine the accuracy of the conclusions listed above.

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New Committee Appointments

Since publication of the March issue, Frank R. Kleffner has been added to the Committee on Convention Program. Dr. Kleffner will be in charge of the Film Theatre.

Two new special committees have also been appointed:

Ad Hoc Committee on Revision of the By-Laws

1. Virgil A. Anderson
2. Grant Fairbanks
3. George A. Kopp
4. Elaine Pagel Paden
5. James F. Curtis, Chairman

Committee on Liaison, Sub-Committee on Relations with the American Psychological Association

1. John W. Keys
2. Wilbert L. Pronovost
3. Joseph M. Wepman
4. Ira J. Hirsh, Chairman

The Social Position Of The Speech Defective Child

Elinor Horwitz Perrin

THE ASSUMPTION is often made by speech therapists that the speech defective child is not an accepted member of his classroom group. Nothing in the way of actual scientific studies, however, have been conducted to support or refute this assumption. Pintner, Eisenson, and Stanton (*2*) make the statement that 'speech defectives make less adequate adjustments than do normal speakers.' The present investigation was undertaken to provide some data concerning the social position of the speech defective child in his school classroom.

The study was carried on in a small midwestern community with a population of 2385. One school building served the town as well as some of the outlying districts. The population was relatively homogeneous; there were no great variations in wealth, most of the people were employed in factories, and the group was entirely white with the exception of a few Mexican families.

Subjects were 445 children in grades one through six. In each class there was at least one child who was receiving instruction from the school's speech therapist; a total of 37 children had speech defects. The majority of children with speech defects had defective articulation, a few of the children stuttered, and two had voice problems.

A sociometric questionnaire of the type used by Moreno (*1*) was the device used to determine the social position of the children. Such a questionnaire consists of one or more questions designed to determine the social status of individuals in a group. In the present study three questions were used to determine each child's best friends. These questions were:

1. What three children would you like best to play with?
2. What three children would you like best to work with?
3. What three children would you like best to have sit next to you?

In grades two to six the regular classroom teachers conducted the rating sessions. The children were told that all of the answers would be kept secret, but that the results would be used to help in organizing play and work groups. The children were then asked to write their answers to the questions on a sheet of paper and hand it to their teacher. In the first grade, where the children could not write, the experimenter conducted short interviews with each child, and she wrote down the desired information.

A similar questionnaire was also administered to the speech defective third, fourth, and fifth graders in their speech correction classes.

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TABLE 1. Incidence of acceptance of children in grades one through six.

	Total Group (N=445)		*Speech Defective (N=37)*		*Non-Defective (N=408)*	
	N	%	*N*	%	*N*	%
Isolates	63	14.2	8	21.6	55	13.5
Neglectees	115	25.8	14	37.8	100	24.5
Stars	29	6.5	0	0.0	29	6.5

After the children had made their choices, the results were tabulated by giving each child one point every time his name was mentioned by another child in response to any of the three questions. For the purposes of this study, children receiving no votes or one vote were considered 'isolates,' children receiving from two to four votes were considered 'neglectees,' and children receiving 20 or more votes were considered 'stars.'

Table 1 summarizes the number of all of the children, of the speech defective children, and of the non-defective children who would be considered isolates, neglectees, or stars under the above criteria.

Results

It was found that there were about a third more isolates among the speech defective children as compared with the non-defective children and with the total of all the children, percentagewise speaking. There were more than half again as many neglectees among the speech defective children as compared with the non-defective children and with the total group. There were no stars to be found among the speech defective children.

In the case of five of the children, the majority of the votes they received in their classrooms were cast by members of their speech correction class. Without these votes, the per cent of isolates for the speech defective group would have been 29.7 instead of 21.6; the per cent of neglectees for the speech defective group would have been 40.5 instead of 37.8; the per cent of the total children who were isolated would then rise from 14.2 to 14.8; and the per cent who were neglected would rise from 25.8 to 26.1.

An analysis of the social position of the children in the speech therapy classes indicates that 58.3 per cent of the children had a higher status (for example, were considered neglectees instead of isolates) in the speech therapy class than in the regular classroom; and 20.8 per cent had a lower status. The smaller, more intimate speech correction group, with its foundation in mutual problems, might account for the increased degree of acceptance. The children with lowered status were all the only girls in a group of boys.

The percentage of isolates for the total number of children, the non-defective children, and the speech defective children remained fairly constant from grade level to grade level, with the exception of the first grade. In this grade, 16 per cent of the children with speech defects were considered isolates, whereas only 3.3 per cent of the non-defective children and 5.6 per cent of the total group were isolates. This is almost four times

as many isolates for the speech defective children as for the non-defective children at that grade level.

From the above data it was concluded that the assumption that many speech defective children are not readily accepted members of their classroom group is probably correct. The reasons for the isolation and neglect of the speech defective children are not made evident by this study, but this study does emphasize the need for the speech therapist being able to help her patients to make a better adjustment in interpersonal situations, especially in the early grades.

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Notice To Subscribers

In spite of continued increase in production costs, the subscription price of the *Journal of Speech and Hearing Disorders* has been maintained at $3.50 for non-members since 1947. It has now become mandatory, however, that the price be raised. With authorization of the Executive Council of ASHA, the Business Manager announces that effective July 1, 1954, the subscription will be $5.00 per year in the United States; $5.50 per year outside the United States; $1.35 per single copy.

A Parent Training Program For A Cerebral Palsy Unit

Helen J. Levinson

THE PARENT training program for speech therapy at P. S. 67, Brooklyn, was part of an intensive program in parent education carried on at the cerebral palsy unit in physical and occupational therapies, in classroom work, in medical and psychological problems, and in speech. This paper is a description of that part of the program concerned with speech therapy.

As the intensive program of therapies and education proceeded at the celebral palsy school units, the need for training parents (*4*), as well as children, became increasingly more apparent. Some uninformed parents, although well-meaning, not only failed to encourage speech, but retarded the work done by the professional therapist or teacher. The entire staff heartily endorsed the plan for training parents, and it was put into practice as soon as the screening was completed and the unit was fully organized. The parents themselves were most enthusiastic about having the program and served as 'secretaries' for it and assisted with car service to the school on meeting days.

Methods in the training program consist of demonstrations in the speech room; individual conferences; group meetings, at which parents participate in discussion of problems; printed notes of suggestions for a home program; occasional individual notes on the child's problems or progress; a bibliography for parents.

Among the problems encountered during the training program, the chief one was attendance, as it is in all adult education projects. Some of the methods found to be successful in overcoming the problem were: (1) Arranging the meeting for the early part of the morning session, so that parents could ride to school with the children and avoid a 'baby-sitting' problem; (2) reminders of the coming meetings a day or two immediately preceding the meeting; (3) reports by parents of progress of children because of instruction given at meetings; (4) demonstrations, with tape recordings, of some of the techniques used with children in the group.

Another problem was grouping, since all of the parents did not need the same material. The subject of each meeting was announced prior to the session so that those who needed the information could take advantage of it. At the opening meeting of the group in January a plan for the year was discussed, and parents suggested the kind of help they wished. The group was, of necessity, somewhat heterogeneous, but this did not hamper progress as all had at least a minimum of interest in each subject. Also, there was sufficient time in the hour or more at these morning meetings for

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review and for questions on individual problems.

Lists of exercises in the printed material had to be checked according to individual needs. One mother was puzzled because the child confused blowing with swallowing, since the mother had given her instruction in both at the same time. For the home program, it was found that one exercise at a time, or one skill at a time, practiced after careful demonstration, was most effective.

Printed material was not given to parents until after it was discussed and the exercises demonstrated and practiced by the parents. Parents were occasionally invited, during visits to speech therapy, to direct a child's exercise under the supervision of the speech therapist.

There were five group sessions, each lasting one and a half hours, one each month, from January through May. The hours were 9:30-11:00 a.m. (and it may be noted that mid-morning coffee served the parents added a friendly and cooperative spirit). The meetings were devoted respectively to 'Physiological Readiness' (*5*), 'Motivation' (*1, 2, 3*), 'Muscle Training' (*7*), 'Sounds in Speech' (*6*), and 'Behavior Problems' (as they affect speech and language development). A bibliography of reading material and recordings was given at the final meeting in May to help guide parents during the summer vacation. The material was shown and some instruction was given for their use.

It was found that 'Physiological Readiness,' more than any other area discussed, can be carried out successfully at home. This leaves the professional speech therapist more time for those things which require special training, i.e., muscle training and phonetics.

One of the findings of the program was the help that could be given parents who came to the school unit with the child for screening. When given printed instructions with demonstrations, if the child was not having speech therapy anywhere, the 'endless waiting' seemed to be alleviated for the parent and she felt that, at last, something definite was being done for the child. If that child remained on the waiting list, opportunity was afforded to note progress after some guidance.

That progress is favorably affected by parent cooperation is obvious. A study of the amount and kind of progress would be worthwhile.

The following materials on 'Physiological Readiness,' 'Motivation,' 'Muscle Training' and 'Sounds,' were given to parents in printed form after discussion of the topics, one at each monthly meeting.

Physiological Readiness for Speech—Sucking, Chewing, Swallowing

Sucking. The child may learn to suck with these materials:

1. A 3" length of plastic tubing in a small graduate or plastic 'glass.'
2. Increasingly longer lengths of tubing.
3. Hard plastic tube ('straw'), commercial type.
4. Regular waxed straw.

Sucking through a straw is necessary to enable your child to acquire sufficient muscular control for the approximation of his lips. This is necessary for understandable speech, as 'b,' 'p,' 'm,' which are used freely in our language, cannot be produced without lip closure.

Defective breathing inhibits speech. Learning to suck is a remedial measure that helps to overcome it. During the early steps of the teaching of sucking you may gently guide the child's upper lip over the end of the tube or straw with your thumb, while you support his chin with your hand. The other hand is free for holding the cup, if it is necessary. The graduate, or larger cup, may have a plastic cover to prevent spilling, with a small hole punched in the center.

The tube is inserted into the cup through this hole.

Allow the child to suck his favorite liquids at home.

Chewing. The Hard Food Orientation Program by Dr. Palmer (5) [a copy was attached], may be referred to if your child's therapist finds him to be in need of such a program. It is not intended for the training of specific muscles, but rather as a general supplement to specific exercises that parents may carry out at home.

Chewing Gum.

1. Insert a small piece of pink bubble gum into the child's mouth. Allow him to enjoy the sweet taste, imitating chewing motions if necessary. Retrieve the gum after a few seconds.

2. Insert the gum for increasingly longer periods.

3. Practice chewing and swallowing the saliva. The child will soon learn that to enjoy the gum he must demonstrate ability to swallow the saliva, not the gum (the gum is always retrieved by the therapist or the mother). This is an aid to the control of drooling.

Motivating the Child to Talk—Social and Emotional Readiness for Speech

Babbling and Vocal Play. Encourage sounds of any kind and vocal exercise when the child is relaxed and playful. After his bath, after meals, or when he is lying in his crib are periods that may be utilized for babbling and vocal play. You may imitate the sounds the child says naturally (any sounds at all) and he may imitate sounds you say directly to him. Vocal exercise may be obtained by varying your pitch and rhythm for simple vowels, as a long 'ah,' a short 'ah,' a long and a short 'oh,' etc. Laughing is also excellent exercise. Yawning has real therapeutic value and if it can be encouraged in play, it will help to develop speech.

Give the child lots of experiences. The child may be taken on visits to relatives and friends. He may be taken on little excursions to the store, the circus, the zoo, the park. With these experiences he will be stimulated and will have ideas to express. He may wish to report the day's experiences to another member of the family.

Give the child a pattern to imitate. Stimulate the child with clear, precise speech. Employ television and good quality records. Tell him stories. Tell him the names of objects that are new in his experience.

Play speech games. Two to four minutes at a time for simple games may bring worthwhile results. Some of these are:

1. Secrets. A word is said directly into the child's ear and he, in turn, says it directly into the ear of another person. Use simple sounds at first, as, 'Ah.' Later, say 'Hello' or 'I love you,' or any 'catchy' phrase the child will like.

2. 'Hide and call.' Have someone help the child to hide. Call to him in a loud voice, slow tempo, '*Where—are—you?*' Tell him, when explaining the game, that he is to say, 'Here—I am.' Often the child will imitate the rhythm or loudness of a phrase before he can say the sounds in it. Accept the child's attempt.

3. Associating a word with action. With the help of a toy, you may be able to stimulate the child to anticipate action, as, letting him say 'up' when 'Jack' is to jump up, or 'play ball' when he wants you to throw the ball toward him, or 'round and round' when the top goes 'round and round.'

4. Picture game. Place a few of the child's favorite pictures before him but out of his reach. Tell him you will give him the pictures he names. Keep a record of his progress.

Discourage gestures. As long as the child can get attention and the objects he wants by indicating with his eyes, hands, head, he will not put forth the effort necessary for real speech. Reward his real speech, even if it is not 'correct.'

Wait for the child to respond with speech. Do not speak for the child. It has been said that the child begins to speak when his mother thinks he is speaking. It is best to think of your child as a speaking child as soon as he is able to speak, even if it takes a long time for his responses to be heard. Delays will become less and less after you have demonstrated to the child that you will be patient because you understand his difficulty of articulation. A little encouragement in the form of a visual cue (a hint) is appropriate if the child has not yet become independent, but work toward more and more independence.

Avoid 'Yes' and 'No' answers. Instead, give the child alternatives, as: 'Do you want to walk or ride?' 'Do you want the blue (book, for example) or the red (book)?' 'Who do you think is at the door? Is it Daddy or Peter?'

Find reasons for speech in simple, everyday activities. It has been found at the school that a child who is just beginning to

use speech can sometimes be given responsibilities through speech, such as carrying oral messages. He may call another child to the room, at the therapist's instruction, saying the child's name for the first time. Children delight in being able to take messages. Keep them simple, of course, as: 'Call Daddy to dinner,' 'Tell me when the bell rings—say 'bell'; 'Tell the paper boy we want a paper—say 'paper'; 'Call Bob.'

Speech is fun. The suggestions given above may be varied, simplified, or added to, according to the child's needs. Take advantage of his playful moods, when he is likely to wish to communicate. Do not put the child under pressure to talk at any time, and be sure to watch for signs of fatigue, when speech may be beyond the child's physical ability. Make speech time 'fun time.'

Muscle Training

Control of the tongue and lips, jaws and soft palate, and breathing mechanism is necessary for understandable speech. In speech therapy there are specific exercises that are planned for each child on an individual basis. Some of the exercises may be supplemented at home, for two or three minutes at a time and a few times each day. If done regularly and in play these exercises should speed progress. Parents are warned against continuing exercises when the child is fatigued. Always end with a feeling of success.

Tongue exercises.

1. Licking a lollypop. Hold the lollypop about ¼-inch from the child's lips in front of his mouth. Let him reach for the lollypop with his tongue-tip. Hold the lollypop at the left corner of the mouth, then at the right, encouraging the child to reach for it. Touch the lips at various points with the sticky lollypop and ask the child to lick the spots.

2. Licking peanut butter. Put a little peanut butter on a tongue blade and place some of it on the upper gum ridge behind the front teeth. Hold the child's chin down so that he reaches with his tongue and not with his jaws. Reaching for the peanut butter will help to exercise his tongue muscles.

3. Other tongue exercises are protruding, as far as the child can; touching the roof of the mouth with the tip and going back toward the soft palate; stretching upward, toward the nose, pointing to either side, and pointing downward. Control of the tongue, rather than random movement, is the goal, although in the early stages, any kind of movement is desirable.

Lip exercises.

1. Gentle massage of the upper and lower lips to achieve lip approximation is beneficial.

2. Rounding the lips, as for 'oo' may be practiced.

3. Spreading the lips and rounding them alternately several times is another good exercise.

Yawning. This is excellent as a relaxation technique as well as an exercise for the soft palate.

Instructions for 'Physiological Readiness —Sucking, Chewing, Swallowing' may be followed throughout the muscle training program.

Exercise of the breathing muscles and many other individual exercises will be the responsibility of the speech therapist. Blowing, however, may be encouraged at home, in play. The child may blow:

a. Light paper 'boats' (small pieces of tissue paper).

b. Birthday candles, and later, larger candles.

c. Toy horns. With these emphasis may be placed on prolonging the sound after the child has learned to produce enough breath for it.

Sounds in Speech

Learning Sounds. A child with normal speech muscles is ready to learn to say the sounds in words correctly after he has mastered a working vocabulary. The cerebral palsied child, however, with involvement of the speech muscles, may not have acquired that vocabulary because of his difficulty in attempting to produce the sounds. These are individual problems, as no two children have exactly the same difficulty.

In speech therapy, the child's tongue, lips, jaws and soft palate are exercised while speech is developing, and you may have been shown some of the exercises that can be done at home. Continue the exercises and also the sucking and chewing program while the child is learning sounds.

In addition to the exercises, there are a number of other ways of helping the child to learn sounds. Here are a few suggestions for learning through ear training:

1. Encourage repetition of the sounds the child can make in play. One child says , 'sh, sh, sh,' to her doll. Another says, 'p, p, p,' while playing with his car, or 'r, r, r,' when playing with his fire engine.

2. Help the child to 'hear' the elemental sounds in a word, by saying the word slowly, or by isolating the sound. Let him watch

your lips as you bring them together for m in 'm-milk,' 'm-mine,' 'm-me,' etc.

3. Play guessing games with words, separating the difficult sound from the rest of the word, and ask the child to guess what object you are looking at, or what object you are holding in your hand. Say, "It is something that begins with 's,'" or, "It is something that ends with 'p.'"

4. Say a series of words with the same sound in it and deliberately say the sound wrong in some of the words. Do it playfully, and ask the child to tell you which sound you said wrong. Soon he will learn to discriminate and will correct himself.

5. Emphasize the sounds that are repeated in rhymes, as for 'j,' 'Jack be nimble, Jack be quick,' and many others.

6. Find small objects at home and put them into boxes, according to the sound the child is learning. Have as many boxes as sounds being emphasized—one for 'b,' one for 'm,' and one for 's,' etc. The sounds and boxes will be different for each child. Some of the children have been bringing objects for the boxes in the speech room at school. They say, "I found a fish for the 'f' box," or, "I saw some sand in the 's' box."

Production of Sounds. The speech therapist will determine what sounds are to be emphasized and when the child is ready to learn through 'ear' alone. Often in cerebral palsy, special techniques for teaching tongue and lip placement and for practicing are given in therapy. Some of these are demonstrated to parents if they wish to have the information and are able to help the child with that part of his training at home. These are delicate procedures, however, and take much time and patience. Parents are, therefore, not urged to teach tongue placement for specific sounds, but to encourage the child to practice the routine tongue exercises, lip and jaw exercises suggested under 'Muscle Training.'

Application of Sounds. Do not interrupt the child to correct his sounds. Let him enjoy his conversation and his fluency. If the proper 'ear training' is given and the child learns to recognize the correct sound, he will correct himself. That is the surest way to better speech. Never associate poor speech with punishment or with any unpleasant talk about it. Rather, save the speech games for a time when you and the child can enjoyably put the 'z, z, z' in buzz and the 'S' in Santa.

Suggested Reading for Parents[1]

1. Barrows, S. T. and K. H. Hall. *Games and Jingles for Speech Development.* Magnolia, Mass.: Expression Co., 1936.
2. Evans, M. F. Efficiency is the goal in cerebral palsied speech. *The Crippled Child,* 29 (6), 1952, 19-21.
3. Huber, M. Letter to the parents of a cerebral palsied child. *The Crippled Child,* 30 (1), 1952, 19-21.
4. Irwin, J. V. and J. K. Duffy. *Speech and Hearing Hurdles.* Columbus, Ohio: School and College Service, 1951.
5. Palmer, M. F. Studies in clinical techniques: II. Normalization of chewing, sucking and swallowing reflexes in cerebral palsy: a home program. *JSD,* 12, 1947, 415-418.
6. Rutherford, B. R. *Give Them a Chance to Talk.* Minneapolis: Burgess Publishing Co., 1950.
7. Van Riper, C. *Helping Children Talk Better.* Chicago: Science Research Associates, Inc., 1951.
8. Westlake, H. A system for developing speech with cerebral palsied children. *The Crippled Child,* 29 (2, 3, 4), 1951, 9-11, 11-13, 18-21.

References

1. Evans, M. F. Problems in cerebral palsy. *JSD,* 12, 1947, 87-103.
2. Gratke, J. M. Speech problems of the cerebral palsied. *JSD,* 12, 1947, 129-134.
3. Hood, P. N., K. H. Shank and D. B. Williamson. Environmental factors in relation to the speech of cerebral palsied children. *JSHD,* 13, 1948, 325-331.
4. Lillywhite, H. Make mother a clinician. *JSHD,* 13, 1948, 61-66.
5. Palmer, M. F. Studies in clinical techniques: II. Normalization of chewing, sucking and swallowing reflexes in cerebral palsy: a home program. *JSD,* 12, 1947, 415-418.
6. Snidecor, J. C. The speech correctionist on the cerebral palsy team. *JSHD,* 13, 1948, 67-70.
7. Westlake, H. Muscle training for cerebral palsied speech cases. *JSHD,* 16, 1951, 103-109.

[1]Reading for the parents in the group at this unit represented a wide variety of levels. Material suggested was, therefore, highly individualized and was given according to the parent's ability to profit by it.

The Speech Correction Fund: Objectives, Policies And Operating Procedures

THE Speech Correction Fund is co-sponsored by the American Speech and Hearing Association and the National Society for Crippled Children and Adults, Inc., the Easter Seal Society. It is designed to provide funds for professional training scholarships and grants-in-aid of research in the field of speech pathology.

The Committee on Speech Correction Fund was created in its original form in December, 1945, by the Executive Council of the American Speech and Hearing Association, and by 1950 the Committee had developed the essential design of the present Fund and had arranged for its joint sponsorship by ASHA and NSCCA. The latter organization provides a national headquarters and a secretary and underwrites certain clerical and administrative expenses. Moreover, the Easter Seal Society provides an economically and legally advantageous corporate structure within which the Committee receives and disburses funds. It is a further advantage of co-sponsorship that the comprehensive program of humanitarian work which is carried on by the National Society for Crippled Children and Adults involves a continuous nation-wide campaign of public enlightenment, recruitment of professional trainees, job placement, the fostering of inter-professional cooperation, and the stimulation of research, clinical, and educational activities on a broad front, and for these reasons it provides a stimulating and congenial setting for the purposes and endeavors of the Committee on Speech Correction Fund.

Co-sponsored as it is by the authoritative nation-wide organization in the field of its professional operations and by the dominant benevolent agency in the broad realm of its humanitarian purposes, the Speech Correction Fund provides a secure and authentic trust for donors and legators who are specifically motivated to benefit the speech handicapped.

In accordance with the present policy the Committee does not conduct fund-raising campaigns and carries on practically no promotional activities of any kind. Aside from the substantial value of the space, personnel, and administrative services provided by the Easter Seal Society, the Fund's income to date has consisted chiefly of scholarship grants

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This statement was prepared by the ASHA Committee on Speech Correction Fund: Herbert Koepp Baker, Sara Stinchfield Hawk, George A. Kopp, M. D. Steer, Robert West and Wendell Johnson, Chairman; with the collaboration of Jayne Shover and Raymond L. Kahn, representatives of NSCCA. It is published at the direction of the Executive Council of ASHA. Copies may be obtained from Secretary George A. Kopp, Speech Clinic, Wayne University, Detroit, Michigan, or from the Speech Correction Fund, Room 1020, 11 S. La Salle St., Chicago 3, Illinois.

from the Kappa Delta Phi Sorority through the channels of the National Society for Crippled Children and Adults; royalties assigned to the Fund by the authors and editors of the book, *Speech Problems of Children*, prepared for NSCCA by ASHA and published by Grune and Stratton, New York City; and contributions from individual donors. One stutterer has indicated an intention to assign a substantial bequest to the Fund. Contributions have been made also by the State University of Iowa Stuttering Team, and speech teachers in the New York City schools have shared with the Fund the receipts from their annual drama festival. The net balance in the Fund at the present time is approximately $4,000.00.

To date, March 1, 1954, practically all disbursements have been in the form of scholarship grants. Six $500.00 scholarships have been awarded.[1] Applicants for scholarship grants are required to hold the Master's degree, or the equivalent, in speech pathology or an allied field, and to meet high standards of scholarship and professional aptitude. Due consideration is given to their professional training objectives and research interests and plans. The fact that an applicant may hold other scholarships, fellowships, or an assistantship does not disqualify him for a Speech Correction Fund Scholarship. Each grant is made as a single payment to the recipient and is transmitted to him through the president of the university or college where the training is to be received. Scholarships must be used at colleges and universities offering graduate training in speech pathology beyond the Master's degree level under the supervision of professional persons eligible for advanced clinical certification by the American Speech and Hearing Association. Each grant is for one year and the recipient may apply for its renewal. Application blanks may be obtained from the Chicago office of the Speech Correction Fund.

In operating in accordance with these policies and regulations, the Committee is governed by three major considerations. The first is that, particularly with limited funds, it appears advisable to do whatever might reasonably be done to insure the greatest possible accomplishment from the funds expended. Accordingly, rigorous selection of recipients seems in order. It is assumed that applicants who have achieved the Master's degree level and are undertaking to go beyond it might with considerable confidence be counted upon to complete their formal training creditably and to remain in the field indefinitely. This granted, such candidates may be expected to contribute over an extended period to the training of many other speech correctionists, to the long-term advancement of scientific work in the field, to the development and improvement of clinical facilities, and, by these means as well as through their own direct efforts, to the practical helping of a very large number of individuals in need of speech correction services. The fact that an ap-

[1]The recipients of these Speech Correction Fund Scholarships and their training centers and areas of research are: Warren R. Dawson (University of Washington, velopharyngeal closure), Halvor P. Hansen (University of Wisconsin, stuttering), John A. MacGahan (University of Chicago, aphasia), Paul H. Ptacek (University of Minnesota, attitudes toward speech disorders), Robert A. Schaef (University of Pittsburgh, evaluation of speech therapy), and Richard A. Winchester (University of Southern California, the brain-injured).

plicant has already been awarded a scholarship or fellowship serves to enhance his recommendations, and if his application clearly indicates a need of financial aid in support of his doctoral research—or perhaps to make possible necessary or clearly desirable travel in connection with graduate study—he would appear to be a more worthy applicant by virtue of his endorsement by another scholarship granting board.

This suggests the second objective of the Committee, which is that of insuring so far as possible that the scholarship grants provide support for worthwhile research as well as for professional training, as such. Practically all graduate students beyond the Master's level in this field do relatively substantial research—and not infrequently the cost of doing this research is not fully covered by such other scholarships or fellowships as the applicants may have received previously. Speech Correction Fund Scholarships are in some cases primarily grants-in-aid of research.

It is the Committee's third consideration that its activities should contribute nationally to the general up-grading of professional training standards in speech pathology. Accordingly, the Committee gives due attention to the qualifications not only of the applicants for scholarship grants but also of the professional training programs in which they are to participate. By so doing it hopes to bring concretely and constructively to the attention of trainees and their sponsors, and the presidents and faculties of training institutions, the professional standards of the American Speech and Hearing Association.

Members of ASHA—and all other interested persons and organizations, as well—can support the Speech Correction Fund primarily in these ways:

1. By giving prospective donors and legators essential information about the Fund—and one way to do this is to make copies of the present statement available to them.

2. By disseminating information about the Fund to students, to new members of the profession, and to the public on appropriate occasions and in a dignified and constructive spirit.

3. By remembering the Fund in their own annual budgets and in the planning of their wills and bequests.

4. By directing worthy students to the Fund as a possible source of scholarship grants.

5. By communicating to the Committee their suggestions for improving Fund policies and procedures.

The Speech Correction Fund is well designed and most fortunately sponsored to serve an impressively constructive and important purpose. Its potential beneficence, conservatively gauged, is heartening. It is the judgment of the Committee that the Speech Correction Fund warrants the support of all members of the profession and of all persons and groups who desire to contribute to the development of speech correction, and to the welfare of the millions of children and adults who need speech correction and stand to be benefited by it.

Book Reviews

VAN RIPER, CHARLES, ED. *Speech Therapy: A Book of Readings.* New York: Prentice-Hall, Inc., 1953. Pp. 319. $3.95.

Undoubtedly those speech therapists in institutions of higher learning who are charged with the responsibility of training new workers will readily agree with Van Riper's introductory statement that 'most instructors would prefer to have their students read more widely' in speech correction literature. To be sure, the advent of a sourcebook (for that is what this book is) does not make insatiable readers of students, but it is an important and helpful step in that direction. There can be little doubt that students will turn to this volume for its carefully selected and, in the main, readable articles.

The major problem for the compiler of a sourcebook is deciding what to include and what to omit. It would be impossible, of course, to please everyone. The only fair question to raise is whether or not Van Riper has, in most instances, selected representative articles and quotations. This reviewer feels that he has.

Nevertheless, one wonders why some of the selections were included at the expense of others. For example, the book contains an article entitled *Blowing Exercises for Cleft Palate Children*, and yet, in the entire volume there is only one very short reference to the problem of delayed speech. This is especially puzzling because Van Riper states in his own preface that he decided 'to emphasize those areas of our field in which there was most controversy.' One might question the space devoted to articles on speech correction activities in many foreign countries. They are interesting, but not necessarily of controversial nature.

On the whole, the organization of the book is good. Some may wonder why the author saw fit to filter out the first 19 articles and set them up under a separate section since all of them could have logically been placed in later sections, the one on delayed speech being the only exception. Van Riper's bridging statements in between many of the quotations are indispensable for they serve as a necessary adhesive to make so many divergent views readable and purposive. Many short and incomplete quotes are included with the express purpose of stimulating a student's interest in wider reading.

The book is more one of theory than of therapy. In the courses that have this volume as required reading, therefore, there should be class discussion of the material in order to help the students see the implications for therapy that the articles hold.

Van Riper has not included any of his own works in the book. His modesty is commendable, but most correctionists will surely feel that Van Riper has made many contributions that students should read along with all those that have found a place.

This book of readings will be widely adopted. It fills a definite need in speech pathology literature. It will help students, and it will prove valuable to instructors.

LYMAN M. PARTRIDGE.
Central Washington College of Education

FLETCHER, HARVEY. *Speech and Hearing in Communication.* New York: D. Van Nostrand Co., 1953. Pp. 461. $9.75.

While this book is based in part on the author's earlier book, *Speech and Hearing* (1929), it deals with much new information which has come from the Bell Telephone Laboratories and other laboratories during the last decade. Four chapters summarize about 30 years of work with Bell Telephone Laboratories by various groups on the perception of speech sounds by listeners having normal hearing. These are the chapters entitled *Measuring the Recognition Aspect of Speech; Specification of the Telephone System Responses, Listener Acuities, and Proficiencies of Talker-Listener Pairs; Methods of Calculating Articulation Scores;* and *Effects of Distortion on the Individual Speech Sounds.*

One chapter extends this information to

Book Reviews is edited by Kenneth Scott Wood, University of Oregon.

the case of deafened listeners, and it is shown what the fundamental criteria must be for designing a hearing aid to be used by a deafened person having any kind or degree of deafness.

The last chapter deals with compensation cases due to injured hearing. The principles developed in the book are applied to this problem. A simple method is evolved for obtaining the effective hearing loss taking into account the hearing loss in both ears. This effective hearing loss is then related to the per cent compensation that such a deafened person should receive compared to that which should be received by a totally deafened person.

A chapter entitled *Space-Time Pattern Theory of Hearing* deals with the dynamics of the middle and inner ear. This is more mathematical than the other chapters. It develops equations from which one can determine the movements of the various parts of the hearing mechanism when a sound is impressed upon the ear drum. The results obtained from these equations are compared with the experimental work of Békésy.

Other chapters are entitled *Speech Sounds of English; The Speaking Mechanism; Characteristics of Speech Waves; Acoustical Speech Powers; Frequency of Occurrence of Different Speech Sounds; Noise; Mechanism of Hearing; Hearing Acuity; Minimum Perceptible Changes in Frequency and Sound Pressure Level; Masking Effects; Loudness; Binaural Hearing Effects; and Auditory Perspective.*

RICHARDSON, E. G., ED. *Technical Aspects of Sound.* (Vol. I: *Sonic Range and Airborne Sound.*) Houston: Elsevier Press, 1953. Pp. 544. $11.00.

This is the first part of a two-volume set written by 22 contributors under the editorship of Dr. Richardson. The second volume, to be issued later this year, will deal with the ultrasonic range and its applications.

This first volume covers the sonic range and, in the main, airborne sound. Building up from the fundamentals of acoustics, the authors have treated acoustic science in six divisions: *Acoustic Measurements and Materials; Acoustics of Buildings; Noise; Speech and Hearing; Sound Reproduction;* and *Analysis and Synthesis of Sound-Design and Performance of Musical Instruments.*

The 133 pages of material in Division IV on *Speech and Hearing* were prepared by members of the Transmission Research Department of Bell Telephone Laboratories. The discussion covers the speech process, the physical characteristics of speech, the power and spectra of speech sounds, the anatomy and physical properties of the ear, characteristics of hearing, intelligibility tests, factors affecting intelligibility, and the theory, classification, and characteristics of microphones.

Division I, consisting of 81 pages on *Acoustic Measurement and Materials* discusses standard sources of frequency and their calibration, the measurement of pressure amplitude and velocity amplitude, and the behavior of absorbing materials.

Division II devotes 49 pages to the theory of sound transmission, room acoustics, and the design of auditoria.

Division III gives 33 pages over to the measurement of noise and noise reduction.

Division V presents in 198 pages the material on *Sound Reproduction* discussing loudspeakers and telephones, sound recording, and stereophonic reproduction.

The last division is an 86-page discussion on the analysis of sound and musical instruments, mechanical and electrophonic.

The bibliographies given at the end of each chapter provide references to specific details.

WEVER, ERNEST G. AND MERLE LAWRENCE. *Physiological Acoustics.* Princeton, N. J.: Princeton University Press, 1954. Pp. 454. $10.00.

The authors treat the ear as an acoustic instrument beginning with the anatomy of the ear, the physical nature of sound, and the methods that have been developed for the study of auditory processes. The discussion in these first three chapters serves to introduce many of the terms and principles which are employed later on and leads up to a consideration of the conditions underlying the ear's sensitivity bringing into focus the problem of the basic function of the middle ear mechanism. The study of the function of the middle ear leads to a formulation of the principles governing its operation as a mechanical transformer; and the reader is confronted with the problem of how energy in the form of aerial waves is effectively utilized by the ear.

Following this examination of the ear's handling of vibratory energy, the authors take up more specifically the efficiency and

the fidelity of the process. The question of distortion in the ear is given detailed attention with evidence presented to support the theory that it is not the middle ear but the sensory cells in the inner ear that introduce distortion in the sounds we hear.

A major problem, and one given particular attention, is how sounds enter the cochlea and how they act upon its internal structures in producing their patterns of sensory stimulation. After discussing the trends of present thinking on this problem, the authors present what they regard as the simplest and most satisfactory theory of this process.

Two chapters are devoted to derangements of the conductive mechanism and the forms of deafness which result. Special attention is given to otosclerosis.

In the final chapters many of the facts and principles developed earlier in the book are brought together and evaluated further to show the present status of knowledge in the field.

The volume includes a glossary of abbreviations and symbols as well as a number of appendices containing physical, mathematical, and anatomical data commonly used in connection with auditory problems. There is also a list of specific reference sources.

Existing facts and the more credible opinions about hearing are reviewed critically, points of agreement and conflict indicated, and interpretations given. Reports of several new experiments by the authors are presented on such topics as *the drum-lever hypothesis, the lever action of the ossicles, location of the rotational axis of the cat's ossicular chain, the electrical conductivity of the cochlea,* and *the lengths of the fluid pathways of the cochlea.*

Speech Problems of School Children: A Symposium. Chicago: The National Society for Crippled Children and Adults, 1953. Pp. 60. $1.25.

This pamphlet presents the papers and the discussion which were given in the second annual symposium co-sponsored by the American Psychological Association, The American Speech and Hearing Association, and The National Society for Crippled Children and Adults.

The papers presented were: *Development of Speech and Language in Children* by M. C. Templin; *Orientation to the Field of Speech Pathology* by Jack Matthews; *Organic Speech Disorders* by Spencer Brown; *Diagnosis of Speech Cases* by C. R. Elliott; *Hearing Disorders* by L. G. Doerfler; *Speech Training Methods* by Darrel Mase; and *Methods of Training Children with Organic Involvements* by Harold Westlake. Discussants included R. L. Schiefelbusch, C. G. Wells, M. Ansberry, L. M. Di Carlo, M. L. Gilmore, and M. H. Powers.

Rehabilitation Centers in the U. S. Chicago: The National Society for Crippled Children and Adults, 1953. Pp. 128. $1.50.

This is a compilation of information submitted by 40 rehabilitation centers for the First National Conference of Rehabilitation Centers held in 1952 which was jointly sponsored by the U. S. Office of Vocational Rehabilitation and the National Society for Crippled Children and Adults.

Smith, Marion F. and Arthur J. Burks. *Teaching the Slow Learning Child.* New York: Harper and Brothers, 1954. Pp. 175. $2.75.

The authors, in popular style, attempt to bring out the 'human side' of the problem of educating retarded children. They express the conviction that most retarded children can be educated to become self-supporting and socially responsible citizens.

The book is written to the public and refers to children with IQ's of from 50-89. The authors contend that it is a mistake to assume that these children cannot learn linguistic skills and number concepts, that they cannot become self-reliant and useful citizens, or that they should be handled in special classes separated from the rest of the school.

Current Publications

Allport, Gordon W. *The Nature of Prejudice.* Cambridge, Mass.: Addison-Wesley Press, 1954. Pp. 555. $5.50.

Bach, George R. *Intensive Group Psychotherapy.* New York: Ronald Press, 1954. Pp. 457. $6.00.

Barr, Avril S., Robert A. Davis and Palmer O. Johnson. *Educational Research and Appraisal.* New York: J. B. Lippincott Co., 1953. Pp. 362. $6.00.

Bender, Lauretta. *Aggression, Hostility, and Anxiety in Children.* Springfield, Ill.: Charles C. Thomas, 1953. $5.50.

BERES, DAVID. *Clinical Notes on Aggression in Children.* New York: Jewish Child Care Assoc. of New York, 1646 York Ave., 1953. Pp. 23. $.50.

BOSSARD, JAMES H. S. *The Sociology of Child Development.* (Rev. ed.) New York: Harper and Brothers, 1954. Pp. 799. $6.00.

BOWEN, WILBUR P. *Applied Anatomy and Kinesiology: The Mechanism of Muscular Movement.* (7th ed., rev. by Henry A. Stone) Philadelphia: Lea and Febiger, 1953. Pp. 462. $5.50.

BUTTON, JOHN C., JR. *Hope and Help in Parkinson's Disease.* New York: Vantage Press, 1953. Pp. 208. $4.95.

CHASE, STUART AND MARIAN T. CHASE. *Power of Words.* New York: Harcourt, Brace and Co., 1954. Pp. 320. $3.95.

DEUTSCH, FELIX. *The Psychosomatic Concept in Psychoanalysis.* New York: International University Press, 1953. Pp. 190. $4.00.

FOREST, ILSE. *Child Development.* New York: McGraw-Hill Book Co., 1954. Pp. 298. $4.00.

FREUD, SIGMUND. *On Aphasia: A Critical Study.* (First English translation of work written 62 years ago.) New York: International University Press, 1953. Pp. 120. $3.00.

HAWKINS, REGINALD R., ED. *Scientific, Medical, and Technical Books Published in the U. S. A.* (Second supplement). New York: R. R. Bowker Co., 1954. Pp. 599. $10.00.

HOVLAND, CARL I. and others. *Communication and Persuasion: Psychological Studies of Opinion Change.* New Haven, Conn.: Yale University Press, 1954. Pp. 327. $4.50.

MECH, EDMUND V. and others. *An Experimental Analysis of Patterns of Differential Verbal Reinforcement in Classroom Situations.* (Indiana University, School of Education Bull., vol. 29, no. 5). Bloomington, Ind.: Indiana University Press, 1953. Pp. 24. $1.00.

MCCORMICK, MARY J. *Diagnostic Case Work in the Thomistic Pattern.* New York: Columbia University Press, 1954. Pp. 253. $3.50.

MCKENZIE, WILLIAM. *Ear, Nose, and Throat Diseases for Medical Students.* Baltimore: Williams and Wilkins Co., 1953. Pp. 260. $5.50.

MCNEIL, C. KERR. *Oral and Facial Deformity.* New York: Pitman Publishing Corp., 1954. Pp. 134. $5.00.

PODOLSKI, EDWARD. *Music Therapy.* New York: Philosophical Library, 1954. Pp. 335. $6.00.

The Pre-adolescent Exceptional Child. (Proceedings of the 35th Conference of the Child Research Clinic of The Woods Schools). Langhorne, Pa.: The Woods Schools, Pp. 66. Gratis.

Prematurity, Congenital Malformation, and Birth Injury. (Proceedings of a conference sponsored by The Assoc. for the Aid of Crippled Children.) New York: Assoc. for the Aid of Crippled Children, 345 E. 46th St., 1953. Pp. 255. $4.00.

The Psychiatrist: His Training and Development. (Report of the 1952 Conference on Psychiatric Education.) Washington: American Psychiatric Assoc., 1953. Pp. 222. $2.50.

RASKIN, NATHANIEL J. AND MARIAN F. WELLER. *Current Research in Work for the Blind: A Survey.* New York: American Foundation for the Blind, 1953. $.50.

Register of Research in the Social Sciences. (No. 10, 1952-53.) New York: Cambridge University Press, 1953. Pp. 213. $4.50.

Rehabilitation Centers in the U. S. Chicago: The National Society for Crippled Children and Adults, 1953. Pp. 128. $1.50.

REMMERS, HERMANN H. *Introduction to Opinion and Attitude Measurement.* New York: Harper and Brothers, 1954. Pp. 445. $5.00.

SMITH, MARION F. AND ARTHUR J. BURKS. *Teaching the Slow Learning Child.* New York: Harper and Brothers, 1954. Pp. 187. $2.75.

Speech Problems of School Children: A Symposium. Chicago: The National Society for Crippled Children and Adults, 1953. Pp. 60. $1.25.

STOLUROW, LAWRENCE M., ED. *Readings in Learning.* New York: Prentice-Hall, Inc., 1953. Pp. 555. $6.00.

WEITZENHOFFER, ANDRE M. *Hypnotism: An Objective Study in Suggestibility.* New York: John Wiley and Sons, 1953. Pp. 396. $6.00.

WEVER, ERNEST G. AND MERLE LAWRENCE. *Physiological Acoustics.* Princeton University Press, 1954. Pp. 454. $10.00.

WHITFIELD, T. C. *An Introduction to Electronics for Physiological Workers.* New York: St. Martin's Press, 1954. Pp. 236. $3.50.

Abstracts

LESSER, A. J. AND E. P. HUNT. The nation's handicapped children. *Amer. J. publ. Hlth Nation's Hlth*, 44, 1954, 166-169.

A survey is presented of the handicapped children in the United States. The nation's crippled children's programs in 1952 treated 4% cleft palate and 5% children with hearing losses. Speech handicapped were stated at about two million children from 5 to 20 years or 5% with speech disorders of such severity as to interfere with their educational progress, social and emotional development. Among this group, 16% had speech disorders associated with other handicapping conditions. Stuttering occurred in 7 per 1,000 children, the number of such children estimated at 270,000. Over half of the children with speech disorders had functional articulatory defects. (*G.M.P.*)

DI CARLO, L. M. AND W. W. AMSTER. The auditorily and speech handicapped. *Rev. educ. Res.*, 23, 1953, 453-475.

This reviews the research literature in the area published since June 1944. Under the heading, 'The Auditorily Handicapped,' are such subdivisions as: Incidence and Educational Provisions, Etiology, Testing, Intelligence, Preschool Training, Educational Placement, Communication Skills, Hearing Aids and Auditory Training, Vocational Services and Adjustment, and Personality. Material on 'The Speech Handicapped' is broken down as follows: Incidence, Functional Articulatory Impairment, Voice, Stuttering, Cleft Palate and/or Cleft Lip, Cerebral Palsy, and Aphasia. An extensive bibliography is included. (*L.L.H.*)

FOOTE, R. M. Medical services to the speech and hearing handicapped in Tennessee. *Laryngoscope*, 63, 1953, 403-411.

Statewide program in Tennessee to discover, treat, and rehabilitate speech and hearing handicapped is described. Comparisons show mass survey method finds larger percentages than teacher referral method. (*F.M.L.*)

BRADFORD, H. F. Oral-aural differentiation among basic speech sounds as a factor in spelling readiness. *Elem. Sch. J.*, 54, 1954, 354-358.

'There is no sense in forcing the child to use oral-aural discrimination of speech sounds as the basis for spelling if he does not possess sufficient maturity to make such discrimination possible.' A test designed to measure a child's readiness to discriminate among regularly spelled speech sounds is explained and the findings from use of this test on 336 first and second grade children in Phoenix, Arizona, schools are given. (*L.L.H.*)

COLEMAN, J. C. Perceptual retardation in reading disability cases. *J. educ. Psychol.*, 44, 1953, 497-503.

A study of visual perception in 40 cases of reading disability indicates that the majority of the cases were retarded in perceptual development. The writer concludes that since perceptual retardation is a significant factor in reading disability there is a need for training in visual discrimination. (*I.H.*)

CORDTS, A. D. How well do you teach phonics. *Instructor*, 63, 1954, 51, 111.

Discussed are several of the methods of teaching phonics and the need for a simple workable technique children can use for identifying new words. Functional phonetics is based on the idea that words, no matter how complex, are made up of a relatively few speech units. The functional

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Abstracts is edited by Jack Matthews, University of Pittsburgh, assisted by the following committee: Asa J. Berlin, Pennsylvania State University; Virginia B. Carroll, Minneapolis Veterans Hospital; Charles F. Diehl, University of Kentucky; James V. Frick, Pennsylvania State University; Inez Hegarty, Mt. Holyoke College; Lester L. Hale, University of Florida; Frank M. Lassman, University of Minnesota; Georgiana M. Peacher, Temple University; Sylvia O. Richardson, San Diego, Calif.; George H. Shames, University of Pittsburgh; D. C. Spriestersbach, State University of Iowa; Jesse J. Villarreal, University of Texas. The committee systematically reviews 203 journals for articles of interest to members of ASHA.

method of teaching phonetics is explained and illustrated. (*L.L.H.*)

DIVIZIA, M. W. New tools in the language arts. *Instructor*, 63, 1954, 29-30.

This article describes the use some elementary teachers have made of the tools of communication to provide a 'stimulating environment' and present challenging situations to children. Through coordination with learning activities, they have furnished concrete experience for language development. (*L.L.H.*)

TEMPLIN, M. C. Phonic knowledge and its relation to the spelling and reading achievement of fourth grade pupils. *J. educ. Res.*, 47, 1954, 441-454.

Phonic ability of 318 fourth grade children was tested with one recall and three recognition tests, and with the author's sound discrimination test. There was evidence that a substantial amount of phonic knowledge had been acquired by these students. The correlation of phonic knowledge with spelling was higher than the correlation with reading. Better spellers received higher scores than poorer spellers on all but the sound discrimination test, and better readers received higher scores than poorer readers on all tests. Tests of phonic recognition produced significantly higher scores than tests of recall. Familiar words produced higher scores than sounds or nonsense words. (*A.J.B.*)

KAPLAN, R. J. Breaking through the language barrier. *J. educ. Sociol.*, 27, 1954, 278-279.

The author names the following areas in which language may become a barrier to understanding: malpropism, translation, use of gestures and facial expressions which are not given the same interpretation everywhere, application of a different 'yardstick,' and the inability of many to relate experiences or render reports in a vivid and properly understood manner. 'If we ignore these difficulties, the barrier [of language] may easily become a wall that cannot be scaled.' (*L.L.H.*)

KLAUSER, S. Z. Communication theory as the unifying theme in teaching educational psychology. *J. educ. Psychol.*, 44, 1953, 483-489.

The author stresses the importance of educating the prospective teacher in the appreciation of the development of meaning in order that he may better understand his students and their learning problems. (*I.H.*)

TROJAN, F. Psychodiagnostik der Sprechstimme. *Folia phoniatr., Basel*, 5, 1953, 216-223.

'The author reports on a new three-part personality test based on psycho-physiology and derived from the expression theory (Ausdruckstheorie) of the human speaking voice. The limits of application of this test in logopaedics and phoniatrics are defined and its reliability examined by means of control tests.' (*A.J.B.*)

BRANDHORST, W. Orthodontics. *Amer. J. Nurs.*, 54, 1954, 175-177.

The author discusses the role of orthodontics and the causes, extent, treatment and prevention of malocclusion. (*J.V.F.*)

KESSLER, H. E. The relationship of dentistry to speech. *J. Amer. dent. Ass.*, 48, 1954, 44-49.

Unintelligible speech can be caused by dental problems involving malocclusion, loss of teeth, prognathism, tongue-tie, cleft palate, shortness of soft palate, dentures or bridges planned without regard for phonetic consequences and fear of showing unsightly dentition. In planning rehabilitation for these problems the dentist can be of great help if he has a knowledge of the functions of the various oral structures in speech production. (*G.H.S.*)

MOOLENAAR-BIJL, A. Connection between consonant articulation and the intake of air in oesophageal speech. *Folia phoniatr., Basel*, 5, 1953, 212-216.

The author recommends insufflating air for oesophageal speech by 'injection.' The oral movements for this maneuver are identical with those used in the production of [p t k] so he recommends beginning speech therapy with these consonants. Roentgenographic study of one patient showed the air volume in the oesophagus remained constant during repetition of the syllable 'pah,' but diminished with repetition of the syllable 'mah.' (*A.J.B.*)

MORRIS, J. V. Cases of elective mutism. *Amer. J. ment. Def.*, 57, 1953, 661-668.

A British study in which individual case histories of six cases are presented. The significant symptoms consist of fully developed speech exhibited towards some persons, coupled with absolute silence in the presence of others. The problem is interpreted as one of social maladjustment, with

the removal of the child from an undesirable environment as a possible solution. Two of the six cases in this series were seen by a speech therapist. (*J.J.V.*)

ZELAN, S., J. G. SHEEHAN AND J. BUGENTAL. Self-perceptions in stuttering. *J. clin. Psychol.*, 10, 1954, 70-72.

Comparisons of 30 stutterers with 130 controls shows them to be significantly different on W-A-Y technique self-percept dimensions of age, positive affect, unit, sex, and group identification. Stutterers in study, however, showed more positive feelings about themselves than controls. Authors feel this is due to overcompensation, or as result of having decided to help themselves through psychotherapy. Use of technique is suggested for predicting response to therapy. (*C.F.D.*)

HAVENS, F. Z. Bilateral paralysis of the vocal cords: treatment by transoral arytenoidectomy. *Laryngoscope*, 63, 1953, 475-484.

Hoarse voice and choking during the days following thyroidectomy suggest that patient has suffered paralysis of one or both cords. Six months after such unilateral paralysis, the patient will probably have no unusual symptoms. Six months after bilateral paralysis, the voice will be normal but the patient may have some dyspnea. (*F.M.L.*)

COURVILLE, C. B. AND J. M. NIELSEN. Cerebral anoxia and convulsive disorders. *Bull. Los Angeles neurol. Soc.*, 18, 1953, 59-73.

Evidence and arguments are presented to show that many of the group of so-called idiopathic or essential epileptics may have been subjected during the birth process to minor and perhaps overlooked episodes of neonatal anoxia where the onset of convulsions may be delayed by years after the anoxic episode. (*J.J.V.*)

FISHER, E. D. AND L. B. MANN, JR. Shift of writing function to minor hemisphere at the age of seventy-two years. *Bull. Los Angeles neurol. Soc.*, 17, 1952, 194-196.

The general point of view is that individuals show a considerable difference in the readiness with which they are able to shift functions to the minor hemisphere when the major hemisphere is damaged. The shift is considered easiest in children and more difficult with advancing age, usually accomplished with difficulty after middle adult life. The present case, in which an elderly woman with advanced left cerebral atrophy readily developed the ability to write with her right hand is considered unusual. The subject's speech is described as occasionally slurred with transitory episodes of stuttering. (*J.J.V.*)

DOLL, E. A. Mental deficiency vs. neurophrenia. *Amer. J. ment. Def.*, 57, 1953, 477-480.

Description of a proposed syndrome, termed neurophrenia, caused by generalized brain damage, which simulates mental deficiency at the level of expressive behavior, but offers hope for amelioration and ultimately adequate social competence. Comparisons are made with other types of CNS impairment. (*J.J.V.*)

SYMONDS, C. Aphasia. *J. Neurol. Neurosurg. Psychiat.*, 16, 1953, 1-6.

Examples illustrating the localization of speech function are given. It was concluded that there were separated anatomical arrangements or neurophysiological dispositions (circuits rather than areas) subserving the psychological function affected. (*G.M.P.*)

WORSTER-DROUGHT, C. Report: Failure in normal language development of neurological origin. *Folia phoniatr., Basel*, 5, 1953, 130-146.

The author reviews types of speech problems resulting from neural damage or agenesis and classified as aphasias or dysarthrias. He discusses symptoms, causes and differential diagnosis. (*A.J.B.*)

BICE, H. Some factors that contribute to the concept of self in the child with cerebral palsy. *Ment. Hyg.*, 38, 1954, 120-131.

Drawing frequently upon statements made by cerebral palsied persons or by their parents in individual and group counseling sessions, the author traces the 'progression in the concepts of the cerebral palsied, from vague recognition that people are assuming a certain attitude directed only toward them, to a realization that this attitude is related to their peculiar physical condition.' (*J.V.F.*)

DINSMORE, M. Teaching reading to the brain-injured child. *Amer. J. ment. Def.*, 58, 1954, 431-435.

Detailed description of objectives and techniques for teaching reading to brain-injured children. (*J.J.V.*)

FOURACRE, M. H. AND E. A. THIEL. Education of children with mental retardation accompanying cerebral palsy. *Amer. J. ment. Def.*, 57, 1953, 401-414.

Recent studies of the distribution of intelligence among children with cerebral palsy are reviewed. These studies suggest that (1) as high as 70% of cerebral palsied children are slow learning, mentally retarded, or mentally deficient; (2) 25% to 30% of school age children with cerebral palsy are not mentally eligible for education in present day public school programs; (3) 40% to 50% of school age c.p.'s are educable, but have below average intelligence; and (4) 25% to 30% of school age c.p.'s have average or better intelligence. Detailed attention is given to appropriate levels of academic instruction of children with both physical and mental handicaps. (*J.J.V.*)

SILVERSTEIN, B., R. C. BELGIS, T. D. HANLEY AND M. D. STEER. The relative intelligibility of male and female talkers. *J. educ. Psychol.*, 44, 1953, 418-428.

Relative intelligibility of speech of men and women was tested over standard military communication equipment. Intelligibility ratings were made in pre-training and post-training tests. A short training period, given to the experimental group, included a lecture on the importance of loudness of voice and clarity of articulation with subsequent practice. Among the significant findings were (1) that untrained men speakers were more intelligible in the pre-test, (2) that a short period of training showed significant intelligibility gains for both men and women speakers, and (3) that sex differences in performance were eliminated by training. (*I.H.*)

BORRECA, F., R. BURGER, I. GOLDSTEIN AND R. SIMCHES. A functional core vocabulary for slow learners. *Amer. J. ment. Def.*, 58, 1953, 273-300.

A suggested revision of standard word lists to meet the special needs and limitations of slow learners. (*J.J.V.*)

FELDMAN, I. S. Psychological differences among moron and borderline mental defectives as a function of etiology. I. Visual-motor functioning. *Amer. J. ment. Def.*, 57, 1953, 484-494.

Comparisons made for two groups, 54 each, of endogenous and exogenous mental defectives, all with speech for communication, on the Bender Visual Motor Gestalt Test showed significantly higher mean raw scores for the exogenous group, and a significant relationship for both groups between MA and B-G scores. It was expected that the latter result would not be true for the exogenous group. Most characteristic of, but not exclusive to, the exogenous group were: (1) perseveration of simple tasks; (2) failure to complete difficult designs; and (3) failure to overlap figures. (*J.J.V.*)

KANNER, L. Parents' feelings about retarded children. *Amer. J. ment. Def.*, 57, 1953, 375-381.

Emphasis on inclusion of emotional factors of family relationships in parent counseling. Typical cases are described. (*J.J.V.*)

MCLEAN, M. C. Easing the load of the limited. *Amer. J. ment. Def.*, 58, 1953, 21-38.

Article describes a film strip prepared as a public relations device for a program of special education in Massachusetts. The present film strip concentrates on a program for the mentally retarded, but describes a medium that could be readily utilized in connection with programs in speech and hearing therapy. (*J.J.V.*)

SCHLANGER, B. B. Speech measurements of institutionalized mentally handicapped children. *Amer. J. ment. Def.*, 58, 1953, 114-122.

A comprehensive study of the language development of 74 institutionalized mentally deficient children with I.Q.'s of 40 and above. Of these children, 68% were judged in need of clinical speech therapy. Speech measures included an articulation index, mean sentence length, words per minute, and sound discrimination. A regression equation is presented which utilized measures of mean sentence length, words per minute, and sound discrimination to predict mental ages, as measured by the Revised Stanford Binet, with an accuracy represented by a coefficient of .74. (*J.J.V.*)

OJALA, L. Pathogenesis and histopathology of chronic adhesive otitis. *Arch. Otolaryng., Chicago*, 57, 1953, 378-401.

Histological characteristics, etiology, pathogenesis, and therapy of adhesive otitis are discussed based upon study of 116 temporal bones. Similarity in clinical characteristics with otosclerosis is drawn. (*F.M.L.*)

News And Announcements

The American Association for Cleft Palate Rehabilitation announces that it will publish its first monograph this year. The Association's quarterly has changed its name from *Newsletter* to *Cleft Palate Bulletin* and has improved its format by a change to a book-size page and the use of a paper-bound cover.

The Oregon College of Education at Monmouth opened its Western Oregon Cooperative Speech and Hearing Center this spring, under the direction of Robert Mulder. The clinic is the last of five clinics recently established to broaden the program of services offered in Oregon. Newly constructed facilities with modern appointments provide for testing, observation, and therapy services.

The Association of Research Libraries, an organization of representatives of 50 of the largest research libraries in the U. S., has begun a program for making available all doctoral dissertations currently accepted by colleges and universities in this country. University Microfilms, Ann Arbor, Michigan, is handling the production and distribution of the microfilms. The microfilms in speech and hearing are listed in News and Announcements as announced, under a cooperative program with University Microfilms.

The Beltone Hearing Aid Company of Chicago has announced the formation of the Beltone Institute for Hearing Research to sponsor a program of original study on hearing problems. Research assignments will be developed and financed in conjunction with the work of hearing centers and of leading universities. In addition to its research projects, the Institute plans to sponsor the translation and distribution to professional men, educational institutions, and the general public of some of the more important studies on hearing not available in English.

M.I.T. has announced the availability of the Owens-Corning Fiberglass Fellowship in Acoustics for 1954-55, which is open to outstanding graduate students whose research interest is in the area of acoustics. Requests for application forms or further information should be addressed to: Dean of the Graduate School, Massachusetts Institute of Technology, Cambridge 39, Mass.

A bill to authorize the establishment of a permanent nine-member National Advisory Committee on Education in the Department of Health, Education, and Welfare has been introduced in the Senate. A companion measure, introduced at the same time, would provide funds for the organization of state and national conferences on education.

Northwestern University is the recipient of a $2,500 gift from the Speech Foundation of America, Memphis, Tennessee, to assist in the development of its program in stuttering rehabilitation.

For the first time in its history the State of New Jersey has made provisions for a State Director of Special Education. Dr. Boyd Nelson, former Director of the School for the Deaf and Blind in Utah, has accepted the position as the State Director of Special Education in New Jersey.

The New York Society for Speech and Voice Therapy meets monthly at Hunter College on Wednesday evenings. The program usually includes demonstrations and lectures in speech pathology. Anyone interested in being included on the mailing list for these meetings should contact Shulamith Kastein at the Columbia Presbyterian Medical Center, West 168th St., New York 32, N. Y.

News and Announcements is edited by Charles R. Elliott, Northwestern University, assisted by the following committee: Jane Beasley, University of Alabama; George Gens, Newark (New Jersey) State Teacher's College; Elise Hahn, University of California at Los Angeles; Earl Schubert, State University of Iowa.

The University of Kentucky is currently in the process of organizing a program in audiology. The program is sponsored by the Lexington Council of Jewish Women and will include diagnostic hearing evaluation, fitting of hearing aids, and retraining. This program will affiliate with the Junior League sponsored program in speech pathology, in its third year at the University.

The New Jersey Society for Crippled Children and Adults is increasing its facilities for speech handicapped individuals by establishing clinics in Morristown and Newton. The Society is currently engaged in organizing a clinic in Atlantic City. In response to many requests, the New Jersey Society is duplicating its series of 10 lectures for parents of handicapped children.

Approximately 30 speech therapists in Western New York held their first organizational meeting on the University of Buffalo campus in March. The planning committee consisted of Betty Gallegher, Elmo Knight, and Katherine Thorn.

The Ninth International Convention for Speech and Voice Therapy of the International Association of Logopedics and Phoniatrics was held in Zurich, Switzerland, September, 1953. Seventeen countries were represented at the meetings of delegates. Dr. R. Luchsinger of the University of Zurich was elected President and Miss Joan VanThal, London, General Secretary. Dr. Emil Froeschels, New York, was made Honorary Life President. The Society has been invited to hold its next convention (1956) in Barcelona.

The Marion County Society for Crippled Children and Adults and the Fairmont Junior League are again cooperatively establishing a fellowship in speech correction at West Virginia University. The academic year 1954-55 will be the second year such a fellowship has been granted. The University remits all tuition and fees to the holder of this fellowship.

Emerson College announces that its second year of affiliation with the Children's Medical Center in Boston has led to the development of a full program in audiology. Adam J. Sortini, Director of the Hearing Clinic, combines the course work with the clinical practicum at the Medical Center.

The Cleveland Hearing and Speech Center held the formal opening of its new Center, described previously in this section, on May 14, 1954.

As an aid to recruitment, the State of Illinois has produced a filmstrip and accompanying record which shows the work of the teachers in the six special programs for handicapped children. Speech correctionists have been urged to use this material to encourage work in speech correction by students planning careers. It is estimated that 100 new speech correctionists could be placed in Illinois this year.

Meetings Announced

American Speech and Hearing Association, October 25-27, Hotel Jefferson, St. Louis.

Speech Association of America, during week of December 26th, Conrad Hilton Hotel, Chicago; week of December 26, 1955, Hotel Statler, Los Angeles.

Regional Speech Meetings: Eastern, March 31-April 2, 1955, Hotel Statler, New York. Southern, first week of April, 1955, Memphis, Tennessee. Central, April 1-2, 1955, Hotel Jefferson, St. Louis.

Acoustical Society of America, spring meeting, June 23-26, Hotel Statler, New York.

American Psychological Association, September 3-8, Hotels Statler and New Yorker, New York.

New Materials

Department of Health, City of New York, 125 Worth St., New York 13, has issued a 14-page mimeographed study of *Standards of Care for Cleft Palate Rehabilitation Centers in Hospitals.* It covers various phases of such programs and is available gratis from the Department of Health.

How to Select Type Faces is a useful booklet available on request from Intertype Corporation, Brooklyn 2, New York.

University Microfilms, Ann Arbor, Michigan, announces the availability of the following microfilms, of possible interest to speech therapists and audiologists: Blaine Lavon Bounous, A Follow-up Study of the Graduates of the Missouri School for the Deaf 1930-1952, Ed.D., Univ. of Mo., 1953, 330 pp., microfilm No. 6034, $4.13; Lillian Edith Hite Haverland, The Effects of Relaxation Training on Certain Aspects of Motor Skill, Ph.D., Univ. of Ill., 1953, 109 pp., microfilm No. 5971, $1.36 Herman C. Axelrod, Bilingual Background and its Relation to Certain Aspects of Character and Personality of Elementary School Children, Ph.D., Yeshiva Univ., 1952, 192 pp., microfilm No. 6322, $2.40; Harold Chenven, Effects of Group Therapy Upon Language Recovery in Predominantly Expressive Aphasics, Ph.D., New York Univ., 1953, 173 pp., microfilm No. 6264, $2.16; John Parker Dolch, An Investigation of Some Phase and Intensity Relationships in the Interference of Bone- and Air-Conducted Sound, Ph.D., State Univ. of Iowa, 1953, 91 pp., microfilm No. 6504, $1.14; Aubrey Epstein, A Study of Reversible Auditory Fatigue Resulting From Exposure to a Pure Tone, Ph.D., State Univ. of Iowa, 1953, 116 pp., microfilm No. 6506, $1.45; Charles D. Parker, The Effects of the Reduction of 'Short Time Fatigue' on Speech Intelligibility for 'Perceptively' Deafened Individuals, Ph.D., State Univ. of Iowa, 1953, 92 pp., microfilm No. 6549, $1.15; Richard McDowell Boehmler, A Quantitative Study of the Extensional Definition of Stuttering With Special Reference to the Audible Designata, Ph.D., State Univ. of Iowa, 1953, 61 pp., microfilm No. 6497, $1.00; Philip Nelson Hood, A Study of the Speech Development and Related Factors in Spastic Hemiplegia, Ph.D., Northwestern Univ., 1953, 278 pp., microfilm No. 6204, $3.48; Ralph R. Leutenegger, A Study of Adaptation and Recovery in the Oral Reading of Stutterers, Ph.D., State Univ. of Iowa, 1953, 82 pp., microfilm No. 6529, $1.03; Keith Lawrence Maxwell, A Comparison of Certain Motor Performances of Children With Normal Speech and Children With Defective Consonant Articulation, Ph.D., Univ. of Mich., 1953, 89 pp., microfilm No. 5703, $1.11.

Audio Devices, 444 Madison Ave., New York 22, has issued a pamphlet discussing many aspects of sound recording, *The Teacher Talks About Sound Recording*, available for the asking.

Graduate Assistantships, Fellowships and Scholarships

This section, an annual feature of the December issue, lists part-time graduate appointments, fellowships, and scholarships specifically designated for graduate work in speech and hearing. General university fellowships and scholarships, unspecified as to area of concentration, and full time graduate positions will not be included. Only those announcements received too late for the December issue are printed in other issues.

Copy should be submitted to the News and Announcements Editor, and should include formal title of appointment, institution, and unit; dates, general duties, and remuneration; name and address of persons receiving applications. Deadline for receiving copy is two months prior to the publication date.

Assistantship. Emerson College. Fifteen hours per week, spent in Hearing Clinic at Children's Medical Center, Boston. Half time. $1,000 for academic year, including remission of tuition. Address Adam J. Sortini, Hearing Clinic, Division of Otolaryngology, Children's Medical Center, 300 Longwood Ave., Boston, Mass.

Assistantships. Temple University. Twenty hours weekly in speech clinic, $900.00 for nine months with waiver of tuition fees. Address Gordon F. Hostettler, Department of Speech and Dramatic Arts, Temple University, Philadelphia 22, Pa.

Assistantships. West Virginia University. Nine months beginning September. Work in Speech and Hearing Clinic 10 to 20 hours per week. Remission of tuition and $400-$800. Students permitted to carry 10 hours of graduate credit each semester toward an M.A. degree. Address J. H. Henning, Department of Speech, West Virginia University, Morgantown, W. Va.

Clinical Assistantship. University of Southern California. Speech-Hearing Clinic. Three to eighteen hours per week. $190 to $1140 per academic year depending upon hours worked. $190 extra for six-weeks

summer session. Students may carry three-fourths normal graduate load. No remission of tuition. Address Milton Dickins, Department of Speech, University of Southern California, Los Angeles 7, California.

Fellowship. West Virginia University. Starting September. $1200 for nine months plus remission of fees. Saturday work as therapist at community speech clinic in nearby city. Student permitted to carry 10 hours credit per semester toward M.A. degree. Address J. H. Henning, Department of Speech, West Virginia University, Morgantown, W. Va.

Scholarships. University of Southern California and John Tracy Clinic. $600 each, covering tuition, books, etc. for teacher training program preparatory to teaching the preschool deaf child. Applicants must have junior standing in a recognized teaching institution or a B.A. degree. Scholarship may be extended to a maximum of $1200. Address Victor P. Garwood, USC-JTC Program, University of Southern California, Los Angeles 7, California.

Training Fellowships. Vanderbilt University School of Medicine. Starting September. Programs leading to M.S. in speech correction or audiology. $1,800-$2,000 for 12 months. Address Forrest M. Hull, The Bill Wilkerson Hearing and Speech Center, Vanderbilt University School of Medicine, Nashville, Tennessee.

News About People

Donald Bersinger has been appointed instructor in speech correction at the University of Tulsa.

Margaret Hall Powers announces the appointment of the following as members of the staff in speech correction for the Chicago Public Schools: Dolores Clinton Bell, Harriet Kopel Horwitz, Bonnie N. Nakamura, Catherine L. Raap, Caryl Weiss Starobin, Rosemary M. Vanderah, Marlene B. Weinstein.

Gertrud L. Wyatt is now engaged full time as a psychologist in addition to her duties as speech correctionist in the public schools of Wellesley, Massachusetts.

Henry C. Youngerman has been appointed Director of the Speech Clinics at the State Teachers College of Fredonia, N. Y.

Elizabeth T. Walpole has retired from private practice in Cincinnati to accept a staff position with the New Jersey Society for Crippled Children and Adults.

Martha Dillenbeck has been appointed Instructor in speech correction at The Pennsylvania State University, to replace William Horean who has been appointed Director of the Speech Clinic at the Williamsport State Hospital.